IB Interview Guide, Module 4: Valuation and DCF Analysis

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Overview & Key Rules of Thumb

If you've already read and understood the guides and lessons on Present Value and IRR, Accounting, and Equity Value and Enterprise Value, **this guide will be straightforward**.

The main difference is that this guide is about the **real-life applications** of those topics, not the theory behind them.

This section **ties together all these concepts** to create something that is useful in real life: An integrated valuation model for a company.

It goes back to **Implied vs. Current Value:** Is a company undervalued, overvalued, or valued appropriately?

With an Excel-based valuation, you can answer that question and then use the results to advise a client or invest your money.

Key Rule #1: The Big Idea Behind DCF Analysis and Valuation

We've continually referenced this formula:

Company Value = Cash Flow / (Discount Rate – Cash Flow Growth Rate)

If a company's Discount Rate and Cash Flow Growth Rate *stay the same forever*, then it should be worth the amount predicted by this formula.

But that is never true in real life.

A company may grow quickly in its early days, but then slow down as it gets bigger and more mature.

And a company's Discount Rate might be very high early on, but then drop to a much lower level as its risk and potential returns both decline.

Since the Discount Rate and Cash Flow Growth Rate change over time, valuation is more complicated than this simple formula.

There are two main ways to reflect this reality more accurately:

1. Project a company's cash flows, and possibly its Discount Rate, **in detail** in the near term – the next 5, 10, or 15 years. And then assume that its Cash Flow Growth Rate and Discount Rate stay the same after that in the **Terminal Period**, and value the company in

that period using the formula above. Discount the values from both periods and add them together.

2. Use **valuation multiples** for the company's near-term financial results – the next year or two – and don't rely on cash flow projections at all. Remember that valuation multiples are **shorthand** for cash flow-based valuation, assuming you've picked appropriate peer companies.

Method #1 is called the **Discounted Cash Flow (DCF) Analysis**, and it's the most *theoretically* correct way to value a company.

For example, you might project a company's cash flows over the next 10 years, and conclude that their Present Value is $1,200 at a Discount Rate of 10% and that the Present Value of the cash flows in its Terminal Period is $1,500.

Based on that, the company's Implied Value is $2,700.

Since you're valuing a company based on its cash flows, as opposed to external factors like other companies, this method is often called **intrinsic valuation**.

Method #2 is known as **relative valuation**. To use it, you have to collect sets of "comparable" companies and M&A transactions, calculate their valuation multiples, and then apply those multiples to the company you're valuing.

For example, similar companies in the sector trade at EV / EBITDA multiples of between 10x and 12x.

Your company has an EBITDA of $200, so its Implied Enterprise Value *should*, therefore, be between $2,000 and $2,400.

There are other methodologies as well, but these are the most important ones.

Once you've valued a company using both relative and intrinsic valuation, you can see how its **Implied Value** compares with its **Current Value**.

For example, maybe the company's Current Enterprise Value is $2,000.

But based on the analysis above – a DCF that produced an Implied Value of $2,700, and comparable companies that showed an Implied Value between $2,000 and $2,400, the company seems **undervalued**.

As an investment banker advising this company, you might use this analysis to tell the Board of Directors the price they might get if they decide to sell the company.

If you're an investor at a private equity firm or hedge fund, you might use this information to conclude that the company is undervalued and could be a good investment if its stock price increases.

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Key Rule #2: DCF – How to Project Free Cash Flow

The first step in a DCF analysis is to project the company's cash flows in the **explicit forecast period**.

"Explicit forecast period" usually means the next 5-10 years, but it could mean 15-20 years or more, depending on the company and industry.

As you know from the guide(s) to valuation metrics and multiples, there are different types of "cash flow": Free Cash Flow, Levered Free Cash Flow, and Unlevered Free Cash Flow.

You should use Unlevered Free Cash Flow in pretty much all DCF analyses.

That means that you need to project the following items:

1. Revenue.
2. COGS and Operating Expenses.
3. Taxes.
4. Depreciation & Amortization (and *sometimes* other recurring, non-cash add-backs).
5. The Change in Working Capital.
6. Capital Expenditures.

You ignore huge chunks of the company's Income Statement and Cash Flow Statement, including Net Interest Expense, Other Income / (Expense), *most* of the non-cash adjustments, the entire Cash Flow from Financing section, and most of the Cash Flow from Investing section.

You ignore them because **those items are non-recurring or relate only to *specific* investor groups rather than all investors**.

Unlevered FCF represents the company's **recurring business cash flow that is available to ALL investors**.

You might remember that we previously defined Unlevered FCF this way:

- **Unlevered Free Cash Flow:** NOPAT + Non-Cash Adjustments and Changes in Working Capital from CFS – CapEx.

NOPAT corresponds to items #1, #2, and #3 above (Revenue, COGS, Operating Expenses, and Taxes), and the Change in Working Capital and CapEx correspond to items #5 and #6 above.

We do **not** include all the "Non-Cash Adjustments" – just **D&A** and not much else.

There are 2 reasons for that:

1) Most of these non-cash adjustments, aside from D&A, are **non-recurring** (e.g., Gains and Losses, Impairments, Write-Downs). And when you *project* Free Cash Flow, you ignore these non-recurring items.

2) And stock-based compensation, the other common, **recurring item** in this section, is **NOT** a real non-cash expense and should **not** be added back to calculate FCF. And, per the definition above, it relates only to a *specific* investor group (Equity investors).

SBC is not a real non-cash expense because it **creates additional shares** and dilutes the existing investors.

Think about it like this: Let's say you have a house worth $10 million, and you pay someone to manage it for you.

Instead of paying him a cash salary of $100,000 per year over 5 years, you award him a 1% ownership stake in the house each year. By the end, he owns 5% of the house.

If you decide to sell the house after 5 years, you'll receive only $9.5 million – not $10.0 million – because someone else owns more of it.

Sure, you haven't paid this person a cash salary, but he **costs** you money because he has reduced your ownership in the house!

It's the same with Stock-Based Compensation: If you add it back as a non-cash expense, you're getting a "free lunch" because you're not reflecting any cash payouts associated with it, nor are you reflecting the additional shares that get created.

The main non-cash adjustment that *doesn't* fit into the guidelines above is **Deferred Income Taxes**.

You *can* include it, but it should decrease as a percentage of book taxes as book vs. cash-tax timing differences reverse.

So if Deferred Taxes initially represent 20% of total Income Taxes, you don't want them to stay at 20% throughout the entire forecast period; they should drop to a much lower percentage, such as 3-5%, by the end.

Here's what **we will project** and what we **won't project** for Steel Dynamics, starting with the Income Statement:

Net sales			
Unrelated parties	$ 7,407,233	$ 8,481,567	$ 7,087,101
Related parties	187,178	274,385	285,823
Total net sales	7,594,411	8,755,952	7,372,924
Costs of goods sold	6,862,693	7,789,741	6,653,780
Gross profit	731,718	966,211	719,144
Selling, general and administrative expenses	327,626	316,214	272,777
Profit sharing	23,064	42,126	27,764
Amortization of intangible assets	25,312	27,551	31,770
Asset impairment charges	428,500	260,000	308
Operating income (loss)	(72,784)	320,320	386,525
Interest expense, net of capitalized interest	153,950	137,263	127,728
Other (income) expense, net	15,383	18,254	(4,033)
Income (loss) before income taxes	(242,117)	164,803	262,830
Income tax expense (benefit)	(96,947)	73,153	99,314
Net income (loss)	(145,170)	91,650	163,516
Net loss attributable to noncontrolling interests	14,859	65,374	25,798
Net income (loss) attributable to Steel Dynamics, Inc.	$ (130,311)	$ 157,024	$ 189,314

You always need to project all of these items (Revenue, COGS, and OpEx), but note that Amortization and Depreciation are often *embedded* within other line items such as COGS.

Don't project this! Impairments, Write-Downs, Gains/Losses, etc. are all non-recurring.

These items shouldn't be a part of *Unlevered* FCF since they relate to debt investors and non-core-business Assets.

You do project Taxes in Unlevered FCF, but they are based on EBIT, not Pre-Tax Income.

And then on the Cash Flow Statement:

Operating activities:			
Net income (loss)	$ (145,170)	$ 91,650	$ 163,516
Adjustments to reconcile net income (loss) to net cash provided by operating activities:			
Depreciation and amortization	294,595	263,325	230,928
Impairment charges	428,500	260,000	308
Equity-based compensation	22,604	14,016	15,504
Deferred income taxes	(99,323)	(25,042)	30,737
Loss on disposal of assets	9,763	5,561	1,082
Changes in certain assets and liabilities:			
Accounts receivable	311,302	(2,191)	(78,237)
Inventories	488,003	68,730	(108,025)
Other assets	3,284	3,064	13,705
Accounts payable	(227,092)	(76,141)	40,141
Income taxes receivable/payable	12,706	(22,086)	(12,494)
Accrued expenses	(60,689)	36,686	15,010
Net cash provided by operating activities	1,038,483	617,572	312,175

Use NOPAT rather than Net Income.

You always project D&A.

Leave these out; non-recurring or not "real" non-cash expenses.

You can project Deferred Income Taxes, but make them decrease over time.

Leave this out; non-recurring.

Include all these Working Capital line items.

You leave out most of Cash Flow from Investing and Cash Flow from Financing, with one exception:

Investing activities:			
Purchases of property, plant and equipment	(114,501)	(111,785)	(186,843)
Proceeds from maturities of short-term commercial paper, net	—	—	31,520
Acquisition of business, net of cash acquired	(45,000)	(1,669,449)	—
Other investing activities	9,874	33,967	2,478
Net cash used in investing activities	(149,627)	(1,747,267)	(152,845)
Financing activities:			
Issuance of current and long-term debt	207,930	1,822,096	423,965
Repayments of current and long-term debt	(612,534)	(635,578)	(517,978)
Proceeds from exercise of stock options, including related tax effect	10,781	32,307	37,508
Contributions from noncontrolling investors	—	5,418	17,860
Distributions to noncontrolling investors	(1,187)	(743)	(439)
Dividends paid	(127,569)	(105,379)	(94,812)
Debt issuance costs	(608)	(22,219)	(6,195)
Net cash provided by (used in) financing activities	(523,187)	1,095,902	(140,091)

Always project CapEx.

These items are all non-recurring, so leave them out.

These items are all either non-recurring or related to *just* Debt or *just* Equity investors, so you exclude this entire section of the CFS when projecting Unlevered FCF.

How to Make the Projections

Once you've decided **what to include** and **what to exclude**, you have to make the actual projections for Unlevered FCF.

This process depends on the company's industry and business segments, but here are a few rules of thumb:

1) Project Revenue.

You could use several approaches to project revenue depending on how much time you have and how much detail you need:

1. Simple % Growth Rate (e.g., assume that revenue grows at 5% per year).
2. Units Sold * Average Selling Price (e.g., assume the company sells 1,000 widgets for $10 each).
3. Market Share * Market Size (e.g., assume the company captures 10% of a $1 billion market).

You must be able to **justify your numbers**, which means that methods #2 and #3 are better if you have the time to use them.

We used method #2 for Steel Dynamics:

Steel Dynamics Inc. - Revenue and Expenses:	Units:	Projected									
		FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Net Sales by Segment:											
Steel Operations:	$ M	$ 5,725.6	$ 6,390.7	$ 7,074.7	$ 7,758.2	$ 8,505.8	$ 9,237.1	$ 10,079.3	$ 10,583.2	$ 11,006.6	$ 11,336.8
Metals Recycling Operations:	$ M	2,266.7	2,317.4	2,540.3	2,777.4	2,965.4	3,162.2	3,368.1	3,469.1	3,538.5	3,609.3
Steel Fabrication Operations:	$ M	729.4	793.5	855.2	921.7	984.0	1,050.4	1,110.7	1,166.2	1,212.9	1,249.3
Other Segments:	$ M	346.3	377.5	411.5	444.4	479.9	513.5	544.4	571.6	594.4	612.3
Inter-Company Eliminations:	$ M	(1,352.0)	(1,473.0)	(1,622.5)	(1,774.5)	(1,928.6)	(2,081.9)	(2,251.8)	(2,354.3)	(2,438.1)	(2,506.0)
Total Consolidated Sales:	$ M	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**	**$ 11,881.3**	**$ 12,850.7**	**$ 13,435.9**	**$ 13,914.3**	**$ 14,301.6**
Annual Growth Rate:	%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Total Shipments by Segment:											
Steel Operations:	K Tons	9,161.0	9,985.5	10,884.1	11,754.9	12,695.3	13,583.9	14,399.0	15,118.9	15,723.7	16,195.4
Metals Recycling Operations:	K Tons	5,964.9	6,263.2	6,513.7	6,774.3	6,977.5	7,186.8	7,402.4	7,624.5	7,777.0	7,932.5
Steel Fabrication Operations:	K Tons	532.4	575.0	615.3	658.4	697.9	739.7	776.7	815.6	848.2	873.6
Total Consolidated Shipments:	K Tons	**15,658.3**	**16,823.7**	**18,013.1**	**19,187.5**	**20,370.6**	**21,510.5**	**22,578.1**	**23,559.0**	**24,348.8**	**25,001.5**
Annual Growth Rate:	%	*8.0%*	*7.4%*	*7.1%*	*6.5%*	*6.2%*	*5.6%*	*5.0%*	*4.3%*	*3.4%*	*2.7%*
Shipment Growth Rates by Segment:											
Steel Operations:	%	10.0%	9.0%	9.0%	8.0%	8.0%	7.0%	6.0%	5.0%	4.0%	3.0%
Metals Recycling Operations:	%	5.0%	5.0%	4.0%	4.0%	3.0%	3.0%	3.0%	3.0%	2.0%	2.0%
Steel Fabrication Operations:	%	8.0%	8.0%	7.0%	7.0%	6.0%	6.0%	5.0%	5.0%	4.0%	3.0%
Average Sales Price Per Ton:											
Steel Operations:	$ 000 / Ton	625.0	640.0	650.0	660.0	670.0	680.0	700.0	700.0	700.0	700.0
Metals Recycling Operations:	$ 000 / Ton	380.0	370.0	390.0	410.0	425.0	440.0	455.0	455.0	455.0	455.0
Steel Fabrication Operations:	$ 000 / Ton	1,370.0	1,380.0	1,390.0	1,400.0	1,410.0	1,420.0	1,430.0	1,430.0	1,430.0	1,430.0
Other Segments Sales Growth:	%	10.0%	9.0%	9.0%	8.0%	8.0%	7.0%	6.0%	5.0%	4.0%	3.0%
Inter-Company Eliminations % Revenue:	%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%

To set this up, we assumed that the company ships a certain amount of steel in each segment and sells each ton for a certain amount. Those figures change over time until revenue growth decreases to a much lower level by the end of Year 10 (FY25 here).

2) Assume an Operating (EBIT) Margin or Project COGS and OpEx.

Similar to step 1, you could make this step simple or complex depending on the time and resources available.

The **simplest** approach is to make the company's Operating Income, or EBIT, a percentage of revenue and to make it grow or decline or over time to reflect business trends.

But you could also project expenses based on individual employees and major categories like rent and marketing, and make everything grow at different rates.

For Steel Dynamics, we chose to keep it relatively simple and projected Operating Margin by Segment:

Steel Dynamics Inc. - Revenue and Expenses:	Units:	Projected FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Net Sales by Segment:											
Steel Operations:	$ M	$ 5,725.6	$ 6,390.7	$ 7,074.7	$ 7,758.2	$ 8,505.8	$ 9,237.1	$ 10,079.3	$ 10,583.2	$ 11,006.6	$ 11,336.8
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Other Segments:	$ M	346.3	377.5	411.5	444.4	479.9	513.5	544.4	571.6	594.4	612.3
Inter-Company Eliminations:	$ M	(1,352.0)	(1,473.0)	(1,622.5)	(1,774.5)	(1,928.6)	(2,081.9)	(2,251.8)	(2,354.3)	(2,438.1)	(2,506.0)
Total Consolidated Sales:	$ M	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**	**$ 11,881.3**	**$ 12,850.7**	**$ 13,435.9**	**$ 13,914.3**	**$ 14,301.6**
Annual Growth Rate:	%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Operating Income by Segment:											
Steel Operations:	$ M	429.4	511.3	601.3	698.2	808.1	923.7	1,007.9	1,058.3	1,100.7	1,133.7
Metals Recycling Operations:	$ M	(11.3)	(11.6)	-	-	14.8	15.8	33.7	34.7	35.4	36.1
Steel Fabrication Operations:	$ M	127.7	142.8	162.5	175.1	196.8	210.1	222.1	233.2	242.6	249.9
Other & Intracompany:	$ M	(166.3)	(181.3)	(197.6)	(213.4)	(230.5)	(246.6)	(261.4)	(274.5)	(285.4)	(294.0)
Operating Margin by Segment:											
Steel Operations:	%	7.5%	8.0%	8.5%	9.0%	9.5%	10.0%	10.0%	10.0%	10.0%	10.0%
Metals Recycling Operations:	%	(0.5%)	(0.5%)	–	–	0.5%	0.5%	1.0%	1.0%	1.0%	1.0%
Steel Fabrication Operations:	%	17.5%	18.0%	19.0%	19.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
Other & Intracompany:	%	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)	(48.0%)

And then we summed up the revenue and operating income for each segment within the Free Cash Flow projections:

Steel Dynamics Inc. - FCF Projections:	Units:	Projected FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Revenue:	$ M	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**	**$ 11,881.3**	**$ 12,850.7**	**$ 13,435.9**	**$ 13,914.3**	**$ 14,301.6**
Revenue Growth Rate:	%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Operating Income (EBIT):	$ M	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**	**1,002.4**	**1,051.8**	**1,093.2**	**1,125.6**
Operating Margin:	%	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*	*7.8%*	*7.8%*	*7.9%*	*7.9%*
Growth Rate:	%	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*	*11.0%*	*4.9%*	*3.9%*	*3.0%*

3) Calculate NOPAT (Net Operating Profit After Taxes).

You should use the company's **effective tax rate**: EBIT * (1 – Tax Rate) = NOPAT. Or you could calculate and show the taxes separately and subtract them from EBIT to get NOPAT.

Don't get hung up on marginal vs. effective vs. statutory rates; just use a percentage that's in-line with historical rates:

	A	B	C	D	E	F	J	K	L	M	N	O	P	Q	R	S
82																
83							Projected									
84			Steel Dynamics Inc. - FCF Projections:			Units:	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
85																
86			**Revenue:**			$ M	**$ 7,716.0**	**$ 8,406.2**	**$ 9,259.3**	**$ 10,127.2**	**$ 11,006.6**	**$ 11,881.3**	**$ 12,850.7**	**$ 13,435.9**	**$ 13,914.3**	**$ 14,301.6**
87			*Revenue Growth Rate:*			%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
88																
89			**Operating Income (EBIT):**			$ M	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**	**1,002.4**	**1,051.8**	**1,093.2**	**1,125.6**
90			*Operating Margin:*			%	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*	*7.8%*	*7.8%*	*7.9%*	*7.9%*
91			*Growth Rate:*			%	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*	*11.0%*	*4.9%*	*3.9%*	*3.0%*
92																
93			(-) Taxes, Excluding Effect of Interest:			$ M	(151.8)	(184.5)	(226.5)	=-M89*Tax_Rate		(361.2)	(400.9)	(420.7)	(437.3)	(450.3)
94																
95			**Net Operating Profit After Taxes (NOPAT):**			$ M	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**	**541.8**	**601.4**	**631.1**	**655.9**	**675.4**

The taxes here should **NOT** reflect the tax benefits of Debt (i.e., the ability to deduct interest expense) since this is an Unlevered analysis.

4) Project Depreciation & Amortization and Possibly Other Non-Cash Adjustments.

You often project D&A as a percentage of revenue, and use the average percentage historically or make it decrease slightly over time as CapEx spending falls.

Deferred Income Taxes as a percentage of Income Statement Taxes should *decrease* over time because they represent simple timing differences.

Something is very wrong with your analysis if Deferred Income Taxes act as major value drivers:

Steel Dynamics Inc. - FCF Projections:	Units:	Projected FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Revenue:	$ M	$ 7,716.0	$ 8,406.2	$ 9,259.3	$ 10,127.2	$ 11,006.6	$ 11,881.3	$ 12,850.7	$ 13,435.9	$ 13,914.3	$ 14,301.6
Revenue Growth Rate:	%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Operating Income (EBIT):	$ M	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**	**1,002.4**	**1,051.8**	**1,093.2**	**1,125.6**
Operating Margin:	%	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*	*7.8%*	*7.8%*	*7.9%*	*7.9%*
Growth Rate:	%	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*	*11.0%*	*4.9%*	*3.9%*	*3.0%*
(-) Taxes, Excluding Effect of Interest:	$ M	(151.8)	(184.5)	(226.5)	(264.0)	(315.7)	(361.2)	(400.9)	(420.7)	(437.3)	(450.3)
Net Operating Profit After Taxes (NOPAT):	$ M	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**	**541.8**	**601.4**	**631.1**	**655.9**	**675.4**
Adjustments for Non-Cash Charges:											
(+) Depreciation & Amortization:	$ M	246.9	=+K99*K86	268.5	293.7	308.2	332.7	347.0	362.8	375.7	386.1
% Revenue:	%	3.2%	3.2%	2.9%	2.9%	2.8%	2.8%	2.7%	2.7%	2.7%	2.7%
(+) Deferred Income Taxes:	$ M	37.9	36.9	34.0	26.4	31.6	18.1	20.0	21.0	21.9	22.5
% Income Statement Taxes:	%	25.0%	20.0%	15.0%	10.0%	10.0%	5.0%	5.0%	5.0%	5.0%	5.0%

The percentage is decreasing slightly over time since CapEx as a % of Revenue also falls.

Historically, Deferred Taxes as a % of Income Taxes have been very high. But we don't want them to be a major value driver, so we greatly decrease the percentages over time.

There may be other recurring items in this section that are related to the company's core business and that are available to all investors, such as Deferred Rent or Deferred Commissions.

For all those, the same methodology applies: Use the historical average percentage of revenue or make these items decline over time since they represent simple timing differences.

You could make this step much more complicated by setting up a full PP&E schedule, splitting CapEx and D&A into different segments, and so on, but that's unnecessary for a quick analysis.

5) Project the Change in Working Capital.

If you've already built a full 3-statement projection model for the company, this part is easy: link to the Change in Working Capital in Cash Flow Statement projections.

If not, we recommend simplifying it and projecting the Change in Working Capital as a percentage of the Change in Revenue, or as a percentage of Revenue.

Remember what the "Change in Working Capital" means: **Does the company *generate* more cash than expected as it grows, or does it *require* more cash to fuel that growth?**

So this section comes down to a simple question: As the company's sales grow, is the Change in Working Capital negative or positive?

We used a simple approach for Steel Dynamics:

Steel Dynamics Inc. - FCF Projections:	Units:	Historical FY13	FY14	FY15	Projected FY16	FY17	FY18	FY19	FY20	FY21
Revenue:	$ M	$ 7,372.9	$ 8,756.0	$ 7,594.4	$ 7,716.0	$ 8,406.2	$ 9,259.3	$ 10,127.2	$ 11,006.6	$ 11,881.3
Revenue Growth Rate:	%	*1.1%*	*18.8%*	*(13.3%)*	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*
Operating Income (EBIT):	$ M	**386.8**	**580.3**	**355.7**	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**
Operating Margin:	%	*5.2%*	*6.6%*	*4.7%*	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*
Growth Rate:	%	*(1.1%)*	*50.0%*	*(38.7%)*	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*
(-) Taxes, Excluding Effect of Interest:	$ M	(154.7)	(232.1)	(142.3)	(151.8)	(184.5)	(226.5)	(264.0)	(315.7)	(361.2)
Net Operating Profit After Taxes (NOPAT):	$ M	**232.1**	**348.2**	**213.4**	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**	**541.8**
Adjustments for Non-Cash Charges:										
(+) Depreciation & Amortization:	$ M	230.9	263.3	294.6	246.9	269.0	268.5	293.7	308.2	332.7
% Revenue:	%	3.1%	3.0%	3.9%	3.2%	3.2%	2.9%	2.9%	2.8%	2.8%
(+) Deferred Income Taxes:	$ M	30.7	(25.0)	(99.3)	37.9	36.9	34.0	26.4	31.6	18.1
% Income Statement Taxes:	%	30.9%	(34.2%)	102.5%	25.0%	20.0%	15.0%	10.0%	10.0%	5.0%
(+/-) Change in Accounts Receivable:	$ M	(78.2)	(2.2)	311.3						
(+/-) Change in Inventory:	$ M	(108.0)	68.7	488.0						
(+/-) Change in Other Assets:	$ M	13.7	3.1	3.3						
(+/-) Change in Accounts Payable:	$ M	40.1	(76.1)	(227.1						
(+/-) Change in Income Tax Payable:	$ M	(12.5)	(22.1)	12.7						
(+/-) Change in Accrued Expenses:	$ M	15.0	36.7	(60.7						
Net Change in Working Capital:	$ M	**(129.9)**	**8.1**	**527.5**	=+I111*(I86-I86)		**(42.7)**	**(43.4)**	**(44.0)**	**(43.7)**
% Change in Revenue:	%	(157.1%)	0.6%	(45.4%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)
% Revenue:	%	*(1.8%)*	*0.1%*	*6.9%*	*(0.1%)*	*(0.4%)*	*(0.5%)*	*(0.4%)*	*(0.4%)*	*(0.4%)*

We simplified these items and just projected the Net Change as a % of the Change in Revenue.

6) Project Capital Expenditures.

Capital Expenditures **must** be linked to the company's sales growth.

Some models assume that CapEx **drives** revenue – for example, as an airline purchases more planes, it can sell more tickets and fly more passengers.

But it doesn't always work like that; CapEx grows as revenue grows, but it doesn't always *drive* revenue.

Some companies, such as those in the software and services sectors, are also far less dependent on CapEx to boost sales.

It's reasonable to make CapEx a percentage of revenue because that reflects the company's ongoing *maintenance* requirements as well as spending required to grow:

Steel Dynamics Inc. - FCF Projections:	Units:	Historical FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
Revenue:	$ M	$ 7,372.9	$ 8,756.0	$ 7,594.4	$ 7,716.0	$ 8,406.2	$ 9,259.3	$ 10,127.2	$ 11,006.6
Revenue Growth Rate:	%	*1.1%*	*18.8%*	*(13.3%)*	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*
Operating Income (EBIT):	$ M	**386.8**	**580.3**	**355.7**	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**
Operating Margin:	%	*5.2%*	*6.6%*	*4.7%*	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*
Growth Rate:	%	*(1.1%)*	*50.0%*	*(38.7%)*	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*
(-) Taxes, Excluding Effect of Interest:	$ M	(154.7)	(232.1)	(142.3)	(151.8)	(184.5)	(226.5)	(264.0)	(315.7)
Net Operating Profit After Taxes (NOPAT):	$ M	**232.1**	**348.2**	**213.4**	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**
Adjustments for Non-Cash Charges:									
(+) Depreciation & Amortization:	$ M	230.9	263.3	294.6	246.9	269.0	268.5	293.7	308.2
% Revenue:	%	3.1%	3.0%	3.9%	3.2%	3.2%	2.9%	2.9%	2.8%
(+) Deferred Income Taxes:	$ M	30.7	(25.0)	(99.3)	37.9	36.9	34.0	26.4	31.6
% Income Statement Taxes:	%	30.9%	(34.2%)	102.5%	25.0%	20.0%	15.0%	10.0%	10.0%
(+/-) Change in Accounts Receivable:	$ M	(78.2)	(2.2)	311.3					
(+/-) Change in Inventory:	$ M	(108.0)	68.7	488.0					
(+/-) Change in Other Assets:	$ M	13.7	3.1	3.3					
(+/-) Change in Accounts Payable:	$ M	40.1	(76.1)	(227.1)					
(+/-) Change in Income Tax Payable:	$ M	(12.5)	(22.1)	12.7					
(+/-) Change in Accrued Expenses:	$ M	15.0	36.7	(60.7)					
Net Change in Working Capital:	$ M	**(129.9)**	**8.1**	**527.5**	**(6.1)**	**(34.5)**	**(42.7)**	**(43.4)**	**(44.0)**
% Change in Revenue:	%	(157.1%)	0.6%	(45.4%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)
% Revenue:	%	*(1.8%)*	*0.1%*	*6.9%*	*(0.1%)*	*(0.4%)*	*(0.5%)*	*(0.4%)*	*(0.4%)*
(-) Capital Expenditures:	$ M	**(186.8)**	**(111.8)**	**(114.5)**	=-J115*J86	**(294.2)**	**(296.3)**	**(324.1)**	**(341.2)**
% Revenue:	%	2.5%	1.3%	1.5%	3.5%	3.5%	3.2%	3.2%	3.1%

CapEx is a simple % of Revenue, and it always stays ahead of D&A.

Notice how D&A as a % of Revenue comes *close to*, but doesn't exactly *reach* CapEx as a % of Revenue. If the company is growing, they should *not* be equal!

Some sources claim that CapEx should "equal" D&A by the end, or in the Terminal Period, but this is **completely wrong**, at least if you assume continued growth in that period.

7) Calculate Unlevered FCF.

You take NOPAT, factor in the non-cash adjustments, the Change in Working Capital, and CapEx to calculate Unlevered FCF:

Steel Dynamics Inc. - FCF Projections:	*Units:*	Historical FY13	Historical FY14	Historical FY15	Projected FY16	Projected FY17	Projected FY18	Projected FY19	Projected FY20	Projected FY21
Revenue:	*$ M*	$ 7,372.9	$ 8,756.0	$ 7,594.4	$ 7,716.0	$ 8,406.2	$ 9,259.3	$ 10,127.2	$ 11,006.6	$ 11,881.3
Revenue Growth Rate:	*%*	*1.1%*	*18.8%*	*(13.3%)*	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*
Operating Income (EBIT):	*$ M*	**386.8**	**580.3**	**355.7**	**379.4**	**461.2**	**566.3**	**660.0**	**789.2**	**903.0**
Operating Margin:	*%*	*5.2%*	*6.6%*	*4.7%*	*4.9%*	*5.5%*	*6.1%*	*6.5%*	*7.2%*	*7.6%*
Growth Rate:	*%*	*(1.1%)*	*50.0%*	*(38.7%)*	*6.7%*	*21.6%*	*22.8%*	*16.5%*	*19.6%*	*14.4%*
(-) Taxes, Excluding Effect of Interest:	*$ M*	(154.7)	(232.1)	(142.3)	(151.8)	(184.5)	(226.5)	(264.0)	(315.7)	(361.2)
Net Operating Profit After Taxes (NOPAT):	*$ M*	**232.1**	**348.2**	**213.4**	**227.7**	**276.7**	**339.8**	**396.0**	**473.5**	**541.8**
Adjustments for Non-Cash Charges:										
(+) Depreciation & Amortization:	*$ M*	230.9	263.3	294.6	246.9	269.0	268.5	293.7	308.2	332.7
% Revenue:	*%*	3.1%	3.0%	3.9%	3.2%	3.2%	2.9%	2.9%	2.8%	2.8%
(+) Deferred Income Taxes:	*$ M*	30.7	(25.0)	(99.3)	37.9	36.9	34.0	26.4	31.6	18.1
% Income Statement Taxes:	*%*	30.9%	(34.2%)	102.5%	25.0%	20.0%	15.0%	10.0%	10.0%	5.0%
Net Change in Working Capital:	*$ M*	**(129.9)**	**8.1**	**527.5**	**(6.1)**	**(34.5)**	**(42.7)**	**(43.4)**	**(44.0)**	**(43.7)**
% Change in Revenue:	*%*	(157.1%)	0.6%	(45.4%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)	(5.0%)
% Revenue:	*%*	*(1.8%)*	*0.1%*	*6.9%*	*(0.1%)*	*(0.4%)*	*(0.5%)*	*(0.4%)*	*(0.4%)*	*(0.4%)*
(-) Capital Expenditures:	*$ M*	**(186.8)**	**(111.8)**	**(114.5)**	**(270.1)**	**(294.2)**	**(296.3)**	**(324.1)**	**(341.2)**	**(368.3)**
% Revenue:	*%*	2.5%	1.3%	1.5%	3.5%	3.5%	3.2%	3.2%	3.1%	3.1%
Unlevered Free Cash Flow:	*$ M*	$ 177.0	$ 482.8	$ 821.7	=+J95+J98+J101+J110+J114	$ 303.3	$ 348.6	$ 428.1	$ 480.5	
Growth Rate:	*%*	*N/A*	*172.7%*	*70.2%*	*(71.2%)*	*7.4%*	*19.4%*	*14.9%*	*22.8%*	*12.2%*

You might also include supplemental information, such as the growth rates and EBITDA, at the bottom.

You can check your work up to this point by looking at the **growth rates** for revenue, Unlevered FCF, and EBITDA.

The whole point of a DCF is that a company's FCF growth eventually slows down at starts growing at about the same rate – the Terminal Growth Rate – into perpetuity.

So if your analysis does **NOT** reflect these slowing growth rates, or if, by the end of the explicit forecast period, the growth rates are much higher than the GDP growth rate or the rate of inflation, you have to re-think your assumptions:

Steel Dynamics Inc. - FCF Projections:	Units:	Projected FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Revenue:	$ M	$ 7,716.0	$ 8,406.2	$ 9,259.3	$ 10,127.2	$ 11,006.6	$ 11,881.3	$ 12,850.7	$ 13,435.9	$ 13,914.3	$ 14,301.6
Revenue Growth Rate:	%	*1.6%*	*8.9%*	*10.1%*	*9.4%*	*8.7%*	*7.9%*	*8.2%*	*4.6%*	*3.6%*	*2.8%*
Unlevered Free Cash Flow:	$ M	$ 236.4	$ 253.9	$ 303.3	$ 348.6	$ 428.1	$ 480.5	$ 534.4	$ 582.6	$ 612.1	$ 635.6
Growth Rate:	%	*(71.2%)*	*7.4%*	*19.4%*	*14.9%*	*22.8%*	*12.2%*	*11.2%*	*9.0%*	*5.1%*	*3.8%*
EBITDA:	$ M	$ 626.4	$ 730.2	$ 834.8	$ 953.7	$ 1,097.4	$ 1,235.7	$ 1,349.3	$ 1,414.6	$ 1,468.9	$ 1,511.8
Growth Rate:	%	*(3.7%)*	*16.6%*	*14.3%*	*14.2%*	*15.1%*	*12.6%*	*9.2%*	*4.8%*	*3.8%*	*2.9%*

Notice how **ALL** of these growth rates slow down over time and approach the expected long-term GDP growth rate or rate of inflation by the end of the 10-year forecast period. That's what we want to see!

If we didn't see both of those, we'd have to go back and revisit the assumptions or possibly extend the forecast period.

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Key Rule #3: DCF – Discount Rates and WACC

Once you've projected the company's **Unlevered Free Cash Flow** in this explicit forecast period, you have to discount those cash flows at the appropriate Discount Rate.

The Discount Rate represents the **opportunity cost** for the investor – what he or she could earn each year by investing in other, similar companies.

A higher Discount Rate means the risk and potential returns are both higher; a lower Discount Rate implies lower risk and potential returns.

A *higher* Discount Rate makes a company *less* valuable because it means the investor has better opportunities elsewhere; the opposite applies for a lower Discount Rate.

You use **WACC**, the Weighted Average Cost of Capital, for the Discount Rate with Unlevered FCF because they both represent **all** the investors in the company.

WACC = Cost of Equity * % Equity + Cost of Debt * (1 – Tax Rate) * % Debt * + Cost of Preferred Stock * % Preferred Stock

That formula seems simple, but there's a lot of disagreement over the proper inputs.

But let's start with the easy parts: **The Costs of Debt and Preferred Stock**.

These represent the rates the company would pay if it issued *additional* Debt or Preferred Stock.

You don't know in advance what those rates will be, but you could make a rough approximation by using the *current* coupon rates on the company's Debt or Preferred Stock.

So if the company has $1,000 of bonds and the coupon rate is 5.0%, that's the company's Pre-Tax Cost of Debt. Interest paid on Debt is tax-deductible, so you multiply by (1 – Tax Rate) to use it in the formula above.

If the company has $1,000 of bonds at a coupon rate of 5.0% and another $1,000 of bonds at a coupon rate of 6.0%, its Pre-Tax Cost of Debt is 5.5%.

If the company has $1,000 in Preferred Stock and it issues $100 in Preferred Dividends per year, the Cost of Preferred Stock is 10.0%. Preferred Dividends are not tax-deductible, so you do **not** multiply by (1 – Tax Rate).

You could also look at the **Yield to Maturity (YTM)** on the Debt, which reflects its current market price, or you could look at coupon rates or the YTM of Debt issued by peer companies.

With the YTM, the basic idea is that if a company's bonds trade at a *discount* to par value (e.g., they were issued at $1,000 but you can buy them for $990 right now), then the yield is **higher** than the coupon rate on the bond.

This is because you can purchase the bonds for $990 and *get back* $1,000 at the end, as well as the interest in between. So if the stated coupon rate is 5.0%, the actual yield is more like 5.2% over a 5-year holding period in this scenario. Getting more back upon maturity boosts the yield.

The opposite applies to bonds trading at a *premium* to par value: The yield you receive will be **less** than the coupon rate on the bond since you get back *less* upon maturity.

Since YTM reflects market conditions, it might be closer to the rate the company would pay on *additional* Debt it issues.

Finally, a more academic approach is to take the **Risk-Free Rate** – the coupon rate on government bonds in the country – and then add a "default spread" based on the company's credit rating.

For example, if the company's EBITDA / Interest is currently 2x and is expected to remain below 2.5x, that might imply a BB+ credit rating.

Companies with BB+ credit ratings might pay, on average, 2.50% above the Risk-Free Rate on Debt they issue.

So if the Risk-Free Rate is currently 3.00%, then the company's Pre-Tax Cost of Debt is 5.50%.

You could use any of these methods to estimate the Cost of Debt, and for most *healthy* companies, they will produce reasonably similar results.

The only difference between the Cost of Debt and Cost of Preferred Stock is that you have to multiply the Pre-Tax Cost of Debt by (1 – Tax Rate) since interest on Debt is tax-deductible.

You don't do this for Preferred Stock because Preferred Dividends are not tax-deductible.

The **Cost of Equity** is much trickier to determine because you cannot observe it.

It tells you how much a company's stock "should" return, on average, over the long term, also factoring in dividends and stock repurchases.

In finance, you usually use the **Capital Asset Pricing Model (CAPM)** to determine the Cost of Equity:

Cost of Equity = Risk-Free Rate + Equity Risk Premium * Levered Beta.

The **Risk-Free Rate (RFR)** represents what you could earn on "safe" government bonds denominated in the same currency as this company's cash flows.

So if it's a French company but it has mostly U.S.-based customers, and it records its financials in US Dollars, you would use the current rate on U.S. Treasury bonds.

You'll usually use the rate on 10-year government bonds to match the projection period of the DCF, but 20-year or 30-year rates are common as well.

Levered Beta tells you how *volatile* this stock is relative to the market as a whole, factoring in both the intrinsic business risk and the risk introduced by leverage (Debt).

If Beta is 1.0, when the market goes up by 10%, this company's stock goes up by 10%.

If Beta is 2.0, when the market goes up by 10%, this company's stock goes up by 20%.

If Beta is 0.5, when the market goes up by 10%, this company's stock goes up by 5%.

You could calculate Beta based on the company's stock price history or via the performance of peer companies.

And the **Equity Risk Premium (ERP)** represents the percentage the stock market will return each year, on average, above and beyond the rate on "safe" government bonds.

This one is always linked to a specific country and stock market.

No one ever agrees on how to calculate it.

The main points of disagreement are:

- Do you use **historical numbers** or **projected ones**? Projected ones make more sense, but how can you "project" stock market performance?
- Do you use the **arithmetic** or **geometric** mean?
- What **period** do you use? Do you go back 10 years? 20? 100?

Finance textbooks use numbers ranging from 3% to 11% for the ERP; we tend to stick to numbers in the middle of that range, such as 6-8%, for companies in developed countries like the U.S. and U.K.

This number will be significantly higher in emerging markets and developing countries (e.g., Africa, Latin America, and parts of Asia) because the risk and potential returns are higher.

If the company has a presence in multiple countries, you might have to "weight" the Equity Risk Premium and multiply the ERP of each country by the % revenue from that country to determine the company-wide ERP.

Don't obsess too much over these calculations. No one agrees on how to calculate the Discount Rate, exactly, and estimating the company's cash flows is more important.

The Process of Calculating Cost of Equity

Theoretically, you could use a company's historical Beta in the Cost of Equity calculation and leave it at that.

But it's better to look at **peer companies** and use the median figure from those.

The whole point of a valuation is to determine a company's **Implied Value:** What it *should* be worth according to your views.

But using the company's *past performance* for Beta corresponds more closely to its Current Value, so that approach doesn't move you closer to the goal.

So just like you might calculate EV / EBITDA for similar companies and then apply the median multiple to the company you're valuing, you do something similar with Beta.

But it's not as simple as taking the median Beta from similar companies and using that figure.

Beta always reflects 2 risks: **Inherent business risk** and **risk from leverage**.

When you look up Beta on sources like Google Finance or Bloomberg, it always reflects both those risks.

Each peer company has a different capital structure, so the **risk from leverage** will be different for each one.

To remove this risk from leverage and isolate the **inherent business risk**, you have to "un-lever Beta."

And then you have to "re-lever Beta" to make it reflect the risk from the leverage of the company you're valuing.

Unlevered vs. Levered Beta has nothing to do with Unlevered vs. Levered Free Cash Flow.

You complete this process of un-levering and re-levering Beta *regardless of the type of Free Cash Flow you're using*.

That's because you **always** calculate the Cost of Equity, and the same components always go into the Cost of Equity.

Here's a simple example: Let's say that "Levered Beta" for a peer company is 1.00, and the company has $500 of Debt and an Equity Value of $1,000. Its tax rate is 40%.

Leverage accounts for part of this company's risk, so you need to **reduce Beta** by removing the risk that comes from leverage:

Unlevered Beta = Levered Beta / (1 + Debt/Equity Ratio * (1 – Tax Rate))

Unlevered Beta = 1.00 / (1 + $500 / $1000 * (1 – 40%)) = 0.7692.

This result means that **23% of this company's risk comes from Debt**. It's **not** 33% (1.00 / (1 + $500 / $1,000)) because the tax-deductibility of interest reduces the risk of Debt.

The formula includes a "1 +" in front of "Debt/Equity Ratio * (1 – Tax Rate)" to ensure that **Unlevered Beta is always less than or equal to Levered Beta**.

If there's Preferred Stock as well, the formula becomes:

Unlevered Beta = Levered Beta / (1 + Debt/Equity Ratio * (1 – Tax Rate) + Preferred/Equity Ratio)

So you calculate this "Unlevered Beta" for each peer company. Here's what it looks like in our DCF for Steel Dynamics:

Comparable Companies - Unlevered Beta Calculation:										
Name	Ticker	Levered Beta	Debt	% Debt	Preferred Stock	% Preferred	Equity Value	% Equity	Tax Rate	Unlevered
United States Steel Corp.	X	2.49	$ 3,140.0	50.1%	$ -	–	$ 3,130.1	49.9%	40.0%	=D15/(1+(E15/I15)*(1-K15)+G15/I15)
Nucor Corporation	NUE	1.50	4,357.5	21.8%	-	–	15,609.0	78.2%	29.7%	1.25
Commercial Metals Company	CMC	1.58	1,080.0	37.8%	-	–	1,776.7	62.2%	32.6%	1.12
AK Steel Holding Corporation	AKS	2.57	2,078.1	66.7%	-	–	1,036.2	33.3%	40.0%	1.17
Worthington Industries, Inc.	WOR	1.53	584.0	17.6%	-	–	2,732.3	82.4%	27.1%	1.32
Reliance Steel & Aluminum Co.	RS	1.59	2,169.4	29.2%	-	–	5,259.1	70.8%	31.8%	1.24
Median:		**1.59**	**$ 2,123.8**	**33.5%**	**$ -**	**–**	**$ 2,931.2**	**66.5%**	**32.2%**	**1.25**

Notice how Unlevered Beta is always **less than or equal to** Levered Beta. That's because Levered Beta reflects 2 "risks": Risk from Debt and Inherent Business Risk, while Unlevered Beta just reflects Inherent Business Risk.

If a company had **no Debt**, Unlevered and Levered Beta would be the same.

Then, you re-lever Beta by flipping around the formula above:

Levered Beta = Unlevered Beta * (1 + Debt/Equity Ratio * (1 – Tax Rate) + Preferred/Equity Ratio)

Let's say the median Unlevered Beta for the peer companies is 0.80. The company we're valuing has $800 in Debt, an Equity Value of $2,000, no Preferred Stock, and a tax rate of 40%.

Levered Beta = 0.80 * (1 + $800 / $2000 * (1 – 40%))

Levered Beta = 0.992.

This result tells us: "**If we ignore the risk from the company's Debt, its stock price is about 80% correlated with the stock market as a whole. But once we factor in that risk from Debt, its stock price is nearly 100% correlated."**

We could then use this result to calculate Cost of Equity for the company.

If the Risk-Free Rate is 2.50%, the Equity Risk Premium is 7.00%, and Levered Beta is 0.992:

Cost of Equity = 2.50% + 7.00% * 0.992 = 9.44%.

Just one small problem: You don't necessarily want to use the company's *current* capital structure to calculate Cost of Equity!

This point goes back to the **core purpose of valuation:** Calculating a company's *Implied* Value and seeing how it compares with the company's *Current* Value.

You un-lever Beta from the peer companies and re-lever it to move closer to that *Implied Value*, and you do something similar with capital structure.

Finance textbooks tell you to use the company's "optimal capital structure" or "targeted capital structure" to do this.

So if the company plans to eventually use 40% Debt, 50% Equity, and 10% Preferred Stock, then you should use those figures when re-levering Beta to calculate Cost of Equity.

But in real life, companies never disclose their intended capital structures.

"Optimal capital structure" is the mix of Debt, Equity, and Preferred Stock that minimizes WACC, but it's impossible to observe or calculate.

So as a practical matter, you often use the median capital structure from the peer companies and apply those percentages to your company to determine its "optimal" or "targeted" structure.

Let's say that we analyzed the peer companies for this company with $800 in Debt and an Equity Value of $2,000. The median Debt / Total Capital was 20%, and the median Equity / Total Capital was 80%.

Our company has Total Capital of $2,800, so these numbers tell us that it "should have" 20% * $2,800, or $560, of Debt, and 80% * $2,800, or $2,240, of Equity.

As a result, the calculations for both Levered Beta and Cost of Equity change:

Levered Beta = 0.80 * (1 + $560 / $2,240 * (1 – 40%)) = 0.92.

Cost of Equity = 2.50% + 7.00% * 0.92 = 8.94%.

The interpretation is simple: **Since the company *should have* less Debt in the future, the risk from leverage *will be* lower, making Levered Beta and Cost of Equity both *lower***.

It's fine to use the company's *current* capital structure instead, but you should then use its Historical Levered Beta – avoid the peer companies altogether – to keep things consistent.

Here's what it looks like in real life for Steel Dynamics:

Discount Rate Calculations - Assumptions:	
Risk-Free Rate:	1.55%
Equity Risk Premium:	7.00%
Pre-Tax Cost of Debt:	4.91%
Cost of Preferred Stock:	–

Comparable Companies - Unlevered Beta Calculation:										
Name	Ticker	Levered Beta	Debt	% Debt	Preferred Stock	% Preferred	Equity Value	% Equity	Tax Rate	Unlevered Beta
United States Steel Corp.	X	2.49	$ 3,140.0	50.1%	$ -	–	$ 3,130.1	49.9%	40.0%	1.55
Nucor Corporation	NUE	1.50	4,357.5	21.8%	-	–	15,609.0	78.2%	29.7%	1.25
Commercial Metals Company	CMC	1.58	1,080.0	37.8%	-	–	1,776.7	62.2%	32.6%	1.12
AK Steel Holding Corporation	AKS	2.57	2,078.1	66.7%	-	–	1,036.2	33.3%	40.0%	1.17
Worthington Industries, Inc.	WOR	1.53	584.0	17.6%	-	–	2,732.3	82.4%	27.1%	1.32
Reliance Steel & Aluminum Co.	RS	1.59	2,169.4	29.2%	-	–	5,259.1	70.8%	31.8%	1.24
Median:		**1.59**	**$ 2,123.8**	**33.5%**	**$ -**	**–**	**$ 2,931.2**	**66.5%**	**32.2%**	**1.25**
Steel Dynamics Inc.	**STLD**	**1.72**								

Steel Dynamics Inc. - Levered Beta & WACC Calculation									
	Ticker	Unlevered Beta	Debt	% Debt	Preferred Stock	% Preferred	Equity Value	% Equity	Tax Rate	Levered Beta
Current Capital Structure:	STLD	1.25	$ 2,591.2	30.0%	$ -	–	$ 6,043.2	70.0%	40.0%	1.57
"Optimal" Capital Structure:	STLD	1.25	2,892.9	33.5%	-	–	5,741.5	66.5%	40.0%	1.62

Cost of Equity Based on Comparables, Current Capital Structure:	**12.53%**
Cost of Equity Based on Comparables, "Optimal" Capital Structure:	**12.92%**
Cost of Equity Based on Historical Beta:	**13.59%**

There isn't necessarily one single "correct" way to calculate Cost of Equity, which is why we look at multiple methods here (Current vs. Optimal Capital Structure vs. Historical Beta).

Our **conclusion** is that Cost of Equity is most likely between 12.5% and 13.5%.

The screenshot above might resemble a bag of skittles, but the takeaway is simple: There are many ways of calculating Cost of Equity.

No single method is necessarily "the best," so you look the range of outputs from different methods to estimate it.

Putting It All Together to Calculate WACC

Now you understand everything that makes WACC tricky to calculate:

WACC = Cost of Equity * % Equity + Cost of Debt * (1 – Tax Rate) * % Debt + Cost of Preferred Stock * % Preferred Stock

- You could use the company's **current capital structure** or **optimal/targeted capital structure** for the percentages.
- There are different approaches for calculating **Cost of Equity**, including un-levering and re-levering Beta from peer companies or using the company's historical Beta.
- No one agrees on the appropriate **Equity Risk Premium** to use in the Cost of Equity calculation.

- And there are even different approaches (Coupon rates, YTM, issuances from peer companies) for calculating the **Cost of Debt** and **Cost of Preferred**, though there's less controversy there.

Our advice remains the same: **Don't over-think the calculation**.

Rather than assuming that one approach is "the best," look at a variety of approaches and use the *range* of results. Here's an example for Steel Dynamics:

Steel Dynamics Inc. - Levered Beta & WACC Calculation										
	Ticker	Unlevered Beta	Debt	% Debt	Preferred Stock	% Preferred	Equity Value	% Equity	Tax Rate	Levered Beta
Current Capital Structure:	STLD	1.25	$ 2,591.2	30.0%	$ -	–	$ 6,043.2	70.0%	40.0%	1.57
"Optimal" Capital Structure:	STLD	1.25	2,892.9	33.5%	-	–	5,741.5	66.5%	40.0%	1.62

Cost of Equity Based on Comparables, Current Capital Structure:	12.53%
Cost of Equity Based on Comparables, "Optimal" Capital Structure:	12.92%
Cost of Equity Based on Historical Beta:	13.59%

WACC = Cost of Equity * % Equity + Cost of Debt * (1 - Tax Rate) * % Debt + Cost of Preferred Stock * % Preferred Stock

WACC, Current Capital Structure:	9.65%
WACC, "Optimal" Capital Structure:	9.58%
WACC, Current Capital Structure and Historical Cost of Equity:	10.40%
Average WACC Produced by All Methods:	9.88%

Valuation is all about **ranges**. Which Cost of Equity or WACC is "correct"?

We don't know, and there's no real way to tell. However, we can be reasonably certain that the company's Cost of Equity and WACC are somewhere *within, or close to, these ranges*.

When you create sensitivity tables for the DCF to analyze the company's Implied value under different assumptions, you'll make the Discount Rates in the tables follow these ranges.

Discounting the Cash Flows

Once you have WACC, you go back to your Free Cash Flow projections and **discount FCF in each year to its Present Value**.

You could use the built-in NPV function in Excel, or you could use the formula you learned in the first guide:

Present Value = Cash Flow / ((1 + Discount Rate)^Year #)

The only question is whether you should use *the same* Discount Rate each year.

After all, couldn't a company's risk profile change as it matures over time?

Yes, it could. So if the company is changing significantly over the explicit forecast period, you **should** change its Discount Rate over time.

You might assume that the company's "long-term" Discount Rate is close to the rate for mature companies in the industry.

So if WACC is currently higher than that, you might start out at that higher number and make it decline to the "mature company rate" over time.

For example, if the company's current WACC is between 11% and 13%, and WACC for mature companies in the industry is between 8% and 9%, you might start it at 12% and then reduce it by 0.5% per year until it reaches 8.5% in the final year.

For Steel Dynamics, we used the same WACC each year because:

1) The company is already mature and isn't expected to change significantly in the future.

2) Other mature companies in this industry have WACCs in a similar range.

So we use the same Discount Rate each year, discount each cash flow to its Present Value, and sum up everything:

Steel Dynamics Inc. - FCF Projections:	Units:	Projected FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25
Unlevered Free Cash Flow:	*$ M*	**$ 236.4**	**$ 253.9**	**$ 303.3**	**$ 348.6**	**$ 428.1**	**$ 480.5**	**$ 534.4**	**$ 582.6**	**$ 612.1**	**$ 635.6**
Growth Rate:	*%*	*(71.2%)*	*7.4%*	*19.4%*	*14.9%*	*22.8%*	*12.2%*	*11.2%*	*9.0%*	*5.1%*	*3.8%*
Discount Period:	#	1	2	3	4	5	6	7	8	9	10
Discount Rate (WACC):	%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%	9.88%
Cumulative Discount Factor:	#	0.910	0.828	0.754	0.686	0.624	0.568	0.517	0.471	0.428	0.390
PV of Unlevered FCF:	*$ M*	$ 215.1	$ 210.3	=+L117*L122	$ 239.2	$ 267.3	$ 273.1	$ 276.4	$ 274.2	$ 262.2	$ 247.8

The company isn't changing much over time and is already mature, so we use the same Discount Rate each year. The "Cumulative Discount Factor" is just 1 / ((1 + Discount Rate)^Discount Period).

So we now have the first part of this analysis – the Present Value of the company's Unlevered FCFs in the forecast period.

Return to Top.

Key Rule #4: DCF – Terminal Value

Once you've projected the company's Unlevered FCF, calculated the Discount Rate, and summed up the Present Value of FCF each year, you have to calculate the company's value into the **far-future period**, otherwise known as the **Terminal Period**.

You also move back to my favorite formula:

Company Value = Cash Flow / (Discount Rate – Cash Flow Growth Rate)

This formula *alone* doesn't work for valuation because the company's Cash Flow Growth Rate and Discount Rate change in earlier years.

As a result, you project the company's cash flows explicitly for the first 5, 10, or 15 years.

But in the Terminal Period, you assume that the company's Discount Rate and Cash Flow Growth Rate do stay the same forever.

The company's value in this Terminal Period is called its **Terminal Value**, and you can use the same formula as the one above to calculate it:

Terminal Value = Unlevered FCF / (WACC – Terminal Unlevered FCF Growth Rate)

The "Unlevered FCF" term must be the **first Free Cash Flow generated *in* the Terminal Period**.

So you have to project FCF one year *beyond* the end of the explicit forecast period, which you often do by applying the "Terminal Growth Rate" to the last FCF in the forecast period.

So if you expect the company's FCF to grow at 3% indefinitely, you might assume that its first FCF in the Terminal Period equals its Final Year FCF * 1.03.

That's why people often write the formula like this:

Terminal Value = Final Year FCF * (1 + Terminal FCF Growth Rate) / (Discount Rate – Terminal FCF Growth Rate)

This formula is known as the **Gordon Growth Method**.

The Terminal FCF Growth Rate should be **low** – below the GDP growth rate of the country, and perhaps in-line with the rate of inflation.

If the economy as a whole is growing at 3% per year, no company could ever grow at 5% into perpetuity.

If it did, eventually it would be bigger than the entire economy!

Even if a company grows at a higher rate initially, **growth always slows down over time**.

Here's a growth progression that makes sense and another one that does not make sense:

- **Makes Sense:** In the explicit forecast period, FCF Growth is 10.0% in Year 1, and it declines to 3.0% by Year 10. The Terminal FCF Growth Rate is 2.0%.

- **Does Not Make Sense:** In the explicit forecast period, FCF Growth is 10.0% in Year 1, and it declines to 8.0% by Year 10. The Terminal FCF Growth Rate is 6.0%.

The second scenario doesn't make sense because FCF growth doesn't decline enough in the explicit period, and the Terminal FCF Growth Rate is far too high.

In *developed markets* like the U.S., U.K., and Canada, you should be using numbers like 1-3%.

And even in emerging markets, no company can grow at 6% forever.

China or India might be growing at 6-7% per year *right now*, but that rate will slow down eventually, and *individual companies* will grow at even lower rates.

So even if you're working in an emerging market, you shouldn't use a *dramatically* higher number for the Terminal FCF Growth Rate: Maybe 3-4% instead of 1-2%, but **not** 6-7%.

If the company's FCF growth rate far exceeds this percentage, even at the end of a 10-year projection period, you might extend the projection period.

The FCF growth rate at the end of the explicit forecast period should be *fairly* close to the Terminal FCF Growth Rate.

From the last section, you know that **multiples are shorthand for valuation**, which means that you can also calculate the Terminal Value using the **Multiples Method**.

Terminal Value = Terminal EBITDA or EBIT or NOPAT or FCF Multiple * Relevant Metric

You might base the Terminal Multiple on the multiples of publicly traded peer companies, but you often apply a **substantial discount** because multiples tend to decrease over time.

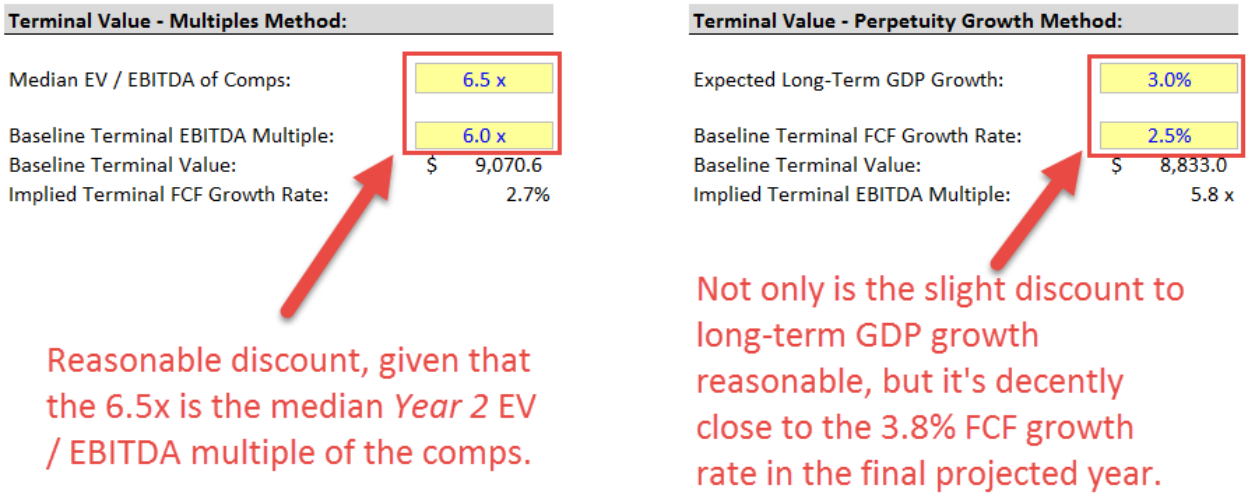
If the Discount Rate remains the same, which should happen for similar companies, then a **higher multiple** implies a **higher growth rate**.

This relationship is why young, fast-growing companies tend to trade at higher multiples, while older, more mature companies tend to trade at lower multiples.

The Discount Rate will also decline over time, but the expected future growth rate will decline by *more than* the Discount Rate in most cases.

So if the peer companies are trading at EBITDA multiples between 10x and 12x, you might reduce that to 8x to 10x for your initial range.

Here are the calculations for Steel Dynamics:



The Most Important Point: Cross-Check Your Work!

Neither method for calculating Terminal Value is "better": They just offer different advantages and disadvantages.

For example, if there are no truly comparable peer companies, the Multiples Method is useless.

But if your country's long-term GDP growth is highly uncertain, or your country's government is unstable, the Gordon Growth Method might not work so well.

So rather than relying on one method, the BEST solution is to use <u>each</u> method to cross-check your work.

For example, let's say you pick 3.0% for the Terminal FCF Growth Rate. That produces a Terminal Value of $1.5 billion, which represents an EBITDA multiple of 10.0x.

The peer companies are currently trading at EBITDA multiples of 12.0x – 14.0x, so this assumption seems reasonable.

But now let's say you pick a Terminal EBITDA multiple of 8.0x, which produces a Terminal Value of $2 billion. The implied Terminal FCF Growth Rate is 6.0%.

Now you have a problem because this number is **way too high**. You need to pick a lower multiple so that the implied Terminal FCF Growth Rate makes more sense.

Calculating the *implied* Terminal Multiple if you've used the Gordon Growth Method is straightforward: Take the Terminal Value and divide by EBITDA, EBIT, or any other metric in the final year.

If you've used the Multiples Method, you can use algebraic manipulation to back into the Implied Growth Rate:

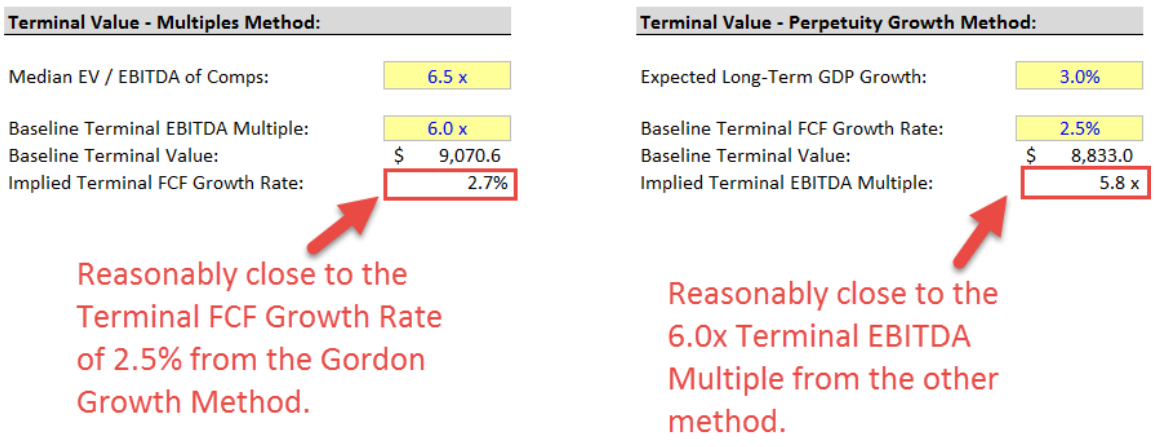
Terminal Value = Final Year FCF * (1 + Terminal FCF Growth Rate) / (Discount Rate – Terminal FCF Growth Rate)

Implied Terminal FCF Growth Rate = (Terminal Value * Discount Rate – Final Year FCF) / (Terminal Value + Final Year FCF)

We're not going to show the full derivation, but you start by multiplying both sides of the first equation by (Discount Rate – Terminal FCF Growth Rate) and then you use algebra to isolate the Terminal FCF Growth Rate term.

You use both methods to cross-check your work and ensure that your Terminal Value assumptions are reasonable.

If your assumptions are **not** reasonable, then you need to pick new ones or change the length of the forecast period. Here are the calculations for Steel Dynamics:



Based on these results, our assumptions seem reasonable.

Discounting and Summing the PV of the Terminal Value

Once you've calculated the Terminal Value, you must **discount it back to its Present Value**.

Remember that the Terminal Value represents a company's value *from* Year 5, 10, or 15, onward into infinity *as of the end* of Year 5, 10, or 15.

But you're concerned with what the company is worth **today**.

You can discount the Terminal Value using the same formula we used for the FCF:

Present Value = Terminal Value / ((1 + Discount Rate)^Year #)

Then, you add the PV of the Terminal Value to the PV of the Free Cash Flows:

Terminal Value - Multiples Method:	
Median EV / EBITDA of Comps:	6.5 x
Baseline Terminal EBITDA Multiple:	6.0 x
Baseline Terminal Value:	$ 9,070.6
Implied Terminal FCF Growth Rate:	2.7%
(+) PV of Terminal Value:	3,536.8
(+) Sum of PV of Free Cash Flows:	2,494.4
Implied Enterprise Value:	**$ 6,031.3**

Terminal Value - Perpetuity Growth Method:	
Expected Long-Term GDP Growth:	3.0%
Baseline Terminal FCF Growth Rate:	2.5%
Baseline Terminal Value:	$ 8,833.0
Implied Terminal EBITDA Multiple:	5.8 x
(+) PV of Terminal Value:	3,444.2
(+) Sum of PV of Free Cash Flows:	2,494.4
Implied Enterprise Value:	**$ 5,938.6**

In an Unlevered DCF analysis, adding these two terms together gives you the company's **Implied Enterprise Value**.

You could **stop** at this point and compare that to the company's Current Enterprise Value.

For private companies, you *do* often stop here.

But if the company is **public**, you have to complete one final step: You back into the company's Implied Equity Value and Implied Share Price.

You already know how to move from Enterprise Value to Equity Value: *Add* non-core-business Assets and *subtract* Liability and Equity line items that represent other investor groups.

Then, you divide by the company's diluted share count to calculate its Implied Share Price, which you then compare to its Current Share Price.

Here are the calculations for Steel Dynamics:

Terminal Value - Multiples Method:		
Median EV / EBITDA of Comps:		6.5 x
Baseline Terminal EBITDA Multiple:		6.0 x
Baseline Terminal Value:	$	9,070.6
Implied Terminal FCF Growth Rate:		2.7%
(+) PV of Terminal Value:		3,536.8
(+) Sum of PV of Free Cash Flows:		2,494.4
Implied Enterprise Value:	**$**	**6,031.3**
% of Implied EV from Terminal Value:		*58.6%*
(+) Cash & Cash-Equivalents:	$	1,052.7
(+) Equity Investments:		-
(+) Other Non-Core Assets, Net:		8.3
(+) Net Operating Losses:		61.1
(-) Total Debt:		(2,591.2)
(-) Preferred Stock:		-
(-) Noncontrolling Interests:		11.2
(-) Unfunded Pension Obligations:		-
(-) Capital Leases:		-
(-) Restructuring & Other Liabilities:		-
Implied Equity Value:		**4,573.4**
Diluted Shares Outstanding:		242.017
Implied Share Price from DCF:	**$**	**18.90**
Premium / (Discount) to Current:		**(24.3%)**

Terminal Value - Perpetuity Growth Method:		
Expected Long-Term GDP Growth:		3.0%
Baseline Terminal FCF Growth Rate:		2.5%
Baseline Terminal Value:	$	8,833.0
Implied Terminal EBITDA Multiple:		5.8 x
(+) PV of Terminal Value:		3,444.2
(+) Sum of PV of Free Cash Flows:		2,494.4
Implied Enterprise Value:	**$**	**5,938.6**
% of Implied EV from Terminal Value:		*58.0%*
(+) Cash & Cash-Equivalents:	$	1,052.7
(+) Equity Investments:		-
(+) Other Non-Core Assets, Net:		8.3
(+) Net Operating Losses:		61.1
(-) Total Debt:		(2,591.2)
(-) Preferred Stock:		-
(-) Noncontrolling Interests:		11.2
(-) Unfunded Pension Obligations:		-
(-) Capital Leases:		-
(-) Restructuring & Other Liabilities:		-
Implied Equity Value:		**4,480.7**
Diluted Shares Outstanding:		242.017
Implied Share Price from DCF:	**$**	**18.51**
Premium / (Discount) to Current:		**(25.9%)**

In real life, you would have to make the calculation for diluted shares **circular** and calculate them *based on* the Implied Share Price, but we skipped that to simplify the model.

Technically, you should also value **out-of-the-money options** and subtract them to calculate the company's Implied Equity Value since they represent potential future ownership.

In practice, however, these options tend to be worth very little, and most banks rarely make this adjustment (there are also other issues, such as the fact that option valuation is a whole separate field of finance).

There is one last point to be careful of: **Don't double-count items**.

It's the same principle that you learned with valuation multiples: If an expense is *included* in the denominator, you should *exclude* the corresponding Asset or Liability in the numerator, and vice versa.

With a DCF analysis, if you *include* an expense within FCF, you should *exclude* the corresponding Asset or Liability when moving from Implied Enterprise Value to Implied Equity Value, and vice versa.

For example, let's say that your FCF projections include the company's Rental Expense within Operating Expenses, so Operating Income and NOPAT are lower as a result.

You should **not** then capitalize the company's Operating Leases and subtract them as a Debt-like item when moving from Implied Enterprise Value to Implied Equity Value.

You've already accounted for them directly within FCF, so you'd be double-counting them if you did this.

Similar logic applies to the Pension Expense and Unfunded Pensions: The *Service Cost* counts as an operating expense and should always be in FCF.

But the Interest Expense, Expected Return on Plan Assets, Amortization of Net Losses or Gains, and Other Adjustments are all financing costs that you should **exclude** from FCF – and then at the end, you should subtract the Unfunded Portion of the Pension as a Debt-like item.

This rule is another way to understand *why* you exclude Interest Income and Interest Expense when calculating Unlevered FCF.

If you *included* them, you would *not* subtract Debt and add Cash to move from Implied Enterprise Value to Implied Equity Value – you'd already **have** Implied Equity Value!

Putting It All Together: What the Steel Dynamics DCF Tells You

When you finish a DCF analysis, the output tells you the company's **Implied Share Price** (or Implied Enterprise Value or Equity Value for private companies) across a range of assumptions.

You can then decide whether the company seems overvalued, undervalued, or valued appropriately.

Since the company's Implied Value varies widely across different assumptions, the DCF analysis is most useful for determining whether or not a company is **greatly** mispriced.

It's useless for detecting differences of, say, 2% or 5%.

You use the DCF, and valuation in general, to see if a company is mispriced by, say, 50% or 80% or 100%.

The results for Steel Dynamics above indicate that the company is **overvalued by around 25%**; if you look at sensitivity tables that calculate its Implied Share Price using different Terminal Value and WACC assumptions, you get these results:

		Weighted Average Cost of Capital (WACC):										
		8.75%	9.00%	9.25%	9.50%	9.75%	**10.00%**	10.25%	10.50%	10.75%	11.00%	11.25%
Terminal EV /	7.00 x	$ 23.81	$ 23.24	$ 22.68	$ 22.13	$ 21.60	**$ 21.08**	$ 20.57	$ 20.07	$ 19.58	$ 19.11	$ 18.64
EBITDA	6.75 x	23.14	22.58	22.03	21.50	20.98	**20.47**	19.98	19.49	19.02	18.56	18.10
Multiple	6.50 x	22.46	21.92	21.39	20.87	20.36	**19.87**	19.39	18.92	18.46	18.01	17.57
(Terminal	6.25 x	21.79	21.26	20.74	20.24	19.75	**19.27**	18.80	18.34	17.89	17.46	17.03
Value	**6.00 x**	**21.11**	**20.60**	**20.10**	**19.61**	**19.13**	**18.67**	**18.21**	**17.77**	**17.33**	**16.91**	**16.49**
Calculated	5.75 x	20.44	19.94	19.45	18.98	18.52	**18.06**	17.62	17.19	16.77	16.36	15.95
Using the	5.50 x	19.76	19.28	18.81	18.35	17.90	**17.46**	17.03	16.62	16.21	15.81	15.41
Multiples	5.25 x	19.09	18.62	18.16	17.72	17.29	**16.86**	16.45	16.04	15.64	15.26	14.88
Method):	5.00 x	18.41	17.96	17.52	17.09	16.67	**16.26**	15.86	15.46	15.08	14.71	14.34

		Weighted Average Cost of Capital (WACC):										
		8.75%	9.00%	9.25%	9.50%	9.75%	**10.00%**	10.25%	10.50%	10.75%	11.00%	11.25%
Terminal FCF	2.80%	$ 24.52	$ 23.16	$ 21.91	$ 20.75	$ 19.67	**$ 18.67**	$ 17.74	$ 16.88	$ 16.06	$ 15.30	$ 14.59
Growth Rate	2.70%	24.18	22.85	21.63	20.49	19.44	**18.46**	17.55	16.70	15.90	15.15	14.45
(Terminal	2.60%	23.85	22.55	21.35	20.25	19.21	**18.26**	17.36	16.52	15.74	15.00	14.31
Value	**2.50%**	23.53	22.26	21.09	20.00	19.00	**18.06**	17.18	16.35	15.58	14.86	14.18
Calculated	2.40%	**23.22**	**21.98**	**20.83**	**19.77**	**18.78**	**17.86**	**17.00**	**16.19**	**15.43**	**14.72**	**14.05**
Using the	2.30%	22.92	21.71	20.59	19.54	18.57	**17.67**	16.82	16.03	15.28	14.58	13.92
Gordon	2.20%	22.62	21.44	20.34	19.32	18.37	**17.48**	16.65	15.87	15.14	14.45	13.80
Growth	2.10%	22.34	21.18	20.11	19.11	18.18	**17.30**	16.49	15.72	15.00	14.32	13.68
Method):	2.00%	22.06	20.93	19.88	18.90	17.98	**17.13**	16.32	15.57	14.86	14.19	13.56

Based on these tables, it seems **exceptionally likely** that the company is overvalued right now because its Implied Share Price is **always** below its Current Share Price.

We're less certain about the exact amount by which it's overvalued, but 20-30% might be a decent guess.

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Key Rule #5: How Different Factors Affect the DCF

Interview questions on **factors that impact a DCF and the Discount Rate** are common.

For example:

- Will Cost of Equity be higher for a $500 million or $5 billion company?
- Will a 1% change in revenue or 1% change in the Discount Rate make a greater impact on the DCF?
- How does a company's WACC change as it uses more Debt?

To understand these questions fully, you need to play around with the **Excel file(s)** included in this course and see how these changes affect everything**.**

But here's the high-level summary:

Changes to the DCF Analysis and the Impact on Cost of Equity, Cost of Debt, WACC, and Implied Value:

DCF Change:	Cost of Equity:	Cost of Debt:	WACC:	Implied Value from Unlevered DCF:
Smaller Company	Higher	Higher	Higher(*)	Lower(*)
Bigger Company	Lower	Lower	Lower(*)	Higher(*)
Emerging Market	Higher	Higher	Higher	Lower
No Debt to Some Debt	Higher	Higher	Lower, then Higher	Higher, then Lower
Some Debt to No Debt	Lower	Lower	Depends	Depends
Higher Risk-Free Rate	Higher	Higher	Higher	Lower
Lower Risk-Free Rate	Lower	Lower	Lower	Higher
Higher Equity Risk Premium	Higher	N/A	Higher	Lower
Lower Equity Risk Premium	Lower	N/A	Lower	Higher
Higher Beta	Higher	N/A	Higher	Lower
Lower Beta	Lower	N/A	Lower	Higher
Higher Taxes	Lower(**)	Lower(**)	Lower(**)	Depends, Usually Lower
Lower Taxes	Higher(**)	Higher(**)	Higher(**)	Depends, Usually Higher

** Assumes the same capital structure percentages – if the capital structure changes, this one could go either way.*

*** Assumes the company has Debt. If it does not, taxes won't make an impact because there won't be any tax savings from interest paid on Debt.*

Overall Impact and Key Drivers

The **Discount Rate** and **Terminal Value** make the biggest impact on the DCF output.

That's because the Discount Rate affects *everything* and because the PV of the Terminal Value often represents over 50% of the company's Implied Value.

Changes in revenue growth, operating margins, and CapEx can also make an impact, but the changes must be *much* larger to make the same impact as a fairly small change to one of the assumptions above.

For example, changing the Discount Rate from 8% to 9% will make a **far bigger** impact than changing the revenue growth from 8% to 9%, or changing the operating margin from 8% to 9%.

Since the Terminal Value contributes so much to the company's total value, small changes to the Terminal FCF Growth Rate or Terminal Multiple can also make a huge impact on the output.

Company Size and Geography

Smaller companies tend to be **riskier** – they have higher growth potential, but also a higher chance of failing.

As a result, they tend to have higher Costs of Equity and Debt and higher WACC figures than larger companies.

Similarly, companies in emerging markets also tend to be **riskier**, with higher growth potential but also a higher risk of collapsing due to political instability.

So the Costs of Equity and Debt and WACC will be higher, and their Implied Values from a DCF will be lower.

Debt and Equity Levels

You have to be **very careful** with these questions because the impact of Debt is not so straightforward.

Recall the diagrams from the guides to Equity Value and Enterprise Value:

How Different Factors Impact WACC, the Cost of Debt, and the Cost of Equity:

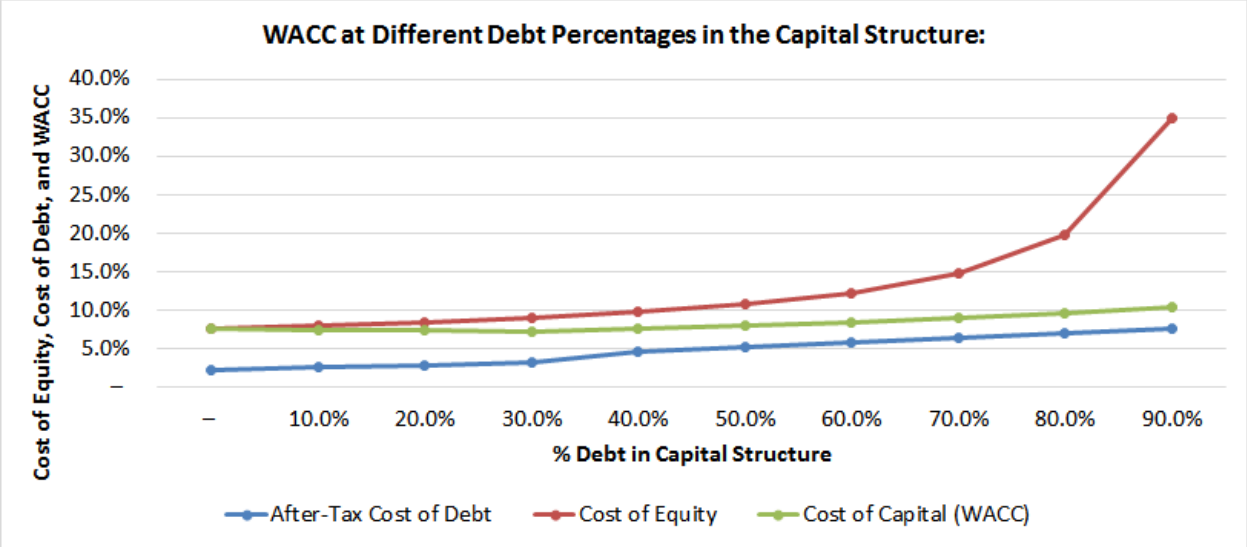
Debt / Total Cap.:	Debt / Equity:	Relevered Beta:	Risk Spread:	Cost of Debt:		Cost of Equity:	Implied WACC:
				Pre-Tax:	After-Tax:		
–	–	0.72	1.0%	3.6%	2.2%	7.7%	7.7%
10.0%	11.1%	0.77	1.5%	4.1%	2.5%	8.0%	7.4%
20.0%	25.0%	0.83	2.0%	4.6%	2.8%	8.4%	7.3%
30.0%	42.9%	0.90	2.5%	5.1%	3.1%	8.9%	7.2%
40.0%	66.7%	1.01	5.0%	7.6%	4.6%	9.7%	7.6%
50.0%	100.0%	1.15	6.0%	8.6%	5.2%	10.7%	7.9%
60.0%	150.0%	1.37	7.0%	9.6%	5.8%	12.2%	8.3%
70.0%	233.3%	1.73	8.0%	10.6%	6.4%	14.7%	8.9%
80.0%	400.0%	2.44	9.0%	11.6%	7.0%	19.7%	9.5%
90.0%	900.0%	4.60	10.0%	12.6%	7.6%	34.8%	10.3%

As a company uses more Debt, its Cost of Debt and Cost of Equity will both increase.

More Debt makes the company riskier for everyone and increases the chance of bankruptcy, which would be catastrophic for *all* investors.

The tricky part is that **WACC decreases initially, but then starts increasing**.

Debt is cheaper than Equity, but past a certain point, the added risk from too much Debt starts to outweigh the cost benefits:



And here's the same annotated diagram we looked at before:

Debt / Total Capital:	Debt / Equity:	Relevered Beta:	Risk Spread:	Cost of Debt: Pre-Tax:	Cost of Debt: After-Tax:	Cost of Equity:	Implied WACC:	"Accounting" Enterprise Value:	Implied Enterprise Value:
–	–	0.72	1.0%	3.6%	2.2%	7.7%	7.7%	$ 10,770.6	$ 10,413.3
10.0%	11.1%	0.77	1.5%	4.1%	2.5%	8.0%	7.4%	10,770.6	10,576.3
20.0%	25.0%	0.83	2.0%	4.6%	2.8%	8.4%	7.3%	10,770.6	10,696.1
30.0%	42.9%	0.90	2.5%	5.1%	3.1%	8.9%	7.2%	10,770.6	10,770.6
40.0%	66.7%	1.01	5.0%	7.6%	4.6%	9.7%	7.6%	10,770.6	10,431.4
50.0%	100.0%	1.15	6.0%	8.6%	5.2%	10.7%	7.9%	10,770.6	10,214.3
60.0%	150.0%	1.37	7.0%	9.6%	5.8%	12.2%	8.3%	10,770.6	9,918.1
70.0%	233.3%	1.73	8.0%	10.6%	6.4%	14.7%	8.9%	10,770.6	9,552.0
80.0%	400.0%	2.44	9.0%	11.6%	7.0%	19.7%	9.5%	10,770.6	9,126.8
90.0%	900.0%	4.60	10.0%	12.6%	7.6%	34.8%	10.3%	10,770.6	8,654.4

The company gets riskier and riskier for *all* investors as it takes on more Debt.

Initially, the Discount Rate decreases as the company uses more Debt, but past a certain point, more Debt starts *increasing* risk and therefore *increasing* the Discount Rate.

If you pretend that the Discount Rate does NOT change as the company uses more Debt, you get these results.

But in reality, the Discount Rate WILL change, so these results are more accurate.

One implication is that if a company goes from **some Debt to no Debt**, **WACC will not change in a predictable way** because it depends on what "some Debt" means.

For example, in the diagram above, the company's WACC at an 80% Debt / Total Capital ratio is 9.5%. So removing Debt would *reduce* its WACC to 7.7% in this case.

But if the company has a 30% Debt / Total Capital ratio, its WACC is 7.2%. So removing Debt would *increase* its WACC to 7.7% now!

Risk-Free Rate

A higher Risk-Free Rate (i.e., if government bonds in the country start offering higher coupon rates) increases the Cost of Equity, the Cost of Debt, and, therefore, WACC.

When government bonds start offering higher rates, investors also start demanding higher rates on corporate bonds, and stock-market investors start demanding higher returns as well.

With a higher Risk-Free Rate, all investors have **better options elsewhere**.

As a result, a company's implied value from a DCF will decline.

Equity Risk Premium

A higher Equity Risk Premium will increase Cost of Equity and WACC because it means that the stock market is expected to return a higher percentage *above* the Risk-Free Rate.

It won't make an impact on the Cost of Debt because Debt investors earn fixed interest on their investments; stock-market performance is irrelevant to them.

So if the ERP increases, the company's Implied Value in a DCF decreases; if it decreases, the company's Implied Value increases.

Beta

This one works the same way as the ERP above: Higher Beta increases the Cost of Equity and WACC and reduces a company's Implied Value, and does the opposite if it's lower.

Just like the ERP, it makes no impact on the Cost of Debt.

A higher Beta means more **stock price volatility**. If a company's Beta is 1.00, investors will expect this company's stock price to increase by 10% when the market goes up by 10%.

But if Beta is now 1.10, investors will expect this company's stock price to increase by 11%.

Since investors' expectations increase, the company's Implied Value *to them* decreases.

Tax Rate

A higher tax rate reduces the Cost of Debt because **it increases the tax benefits of Debt**.

Think about the simple math: If the coupon rate is 10%, the Cost of Debt is 10% * (1 – 40%) = 6% at a 40% tax rate, but 10% * (1 – 50%) = 5% at a 50% tax rate.

But a higher tax rate will also **reduce the Cost of Equity** because you use that tax rate when re-levering Beta: Re-Levered Beta = Unlevered Beta * (1 + Debt/Equity Ratio * (1 – Tax Rate)).

A higher tax rate makes Debt less risky, which means that additional Debt is *also* less risky for the Equity investors.

So WACC **decreases** with a higher tax rate, assuming the company has Debt.

The company's Implied Value from a DCF is harder to predict, but it usually **decreases** because a higher tax rate also reduces the company's Free Cash Flow.

That FCF reduction tends to make a bigger impact than these changes to the Discount Rate.

Other Changes and Factors

We haven't covered every possible factor here, but if you understand the concepts, you can reason your way through anything.

For example, if the company starts using additional Equity, that's the same as using *less Debt*, so all those changes would apply.

Additional Preferred Stock is similar to additional Debt, but there's no tax benefit. So Cost of Equity will increase, and WACC will decrease initially and then start increasing.

If the interest rate on Debt increases, the Cost of Debt will increase and WACC will also increase that higher rate doesn't affect the Cost of Equity.

If a change increases the company's Free Cash Flow, the company's Implied Value will increase because the whole analysis is based on the Present Value of Free Cash Flows.

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Key Rule #6: DCF – More Advanced Points [OPTIONAL]

There are a few more advanced topics related to DCF analysis; you're unlikely to get interview questions on these topics, so you can consider this section "optional."

The Mid-Year Convention and Stub Periods

When you use discount periods of 1, 2, 3, 4, and so on, it's **not accurate** because those whole numbers imply that the company's cash flows all arrive at the *ends* of years.

But that's not true: The company generates cash flow **every day**, and *on average*, it's evenly distributed throughout the year.

So it is more accurate to use discount periods of 0.5, 1.5, 2.5, 3.5, and so on when you're calculating the cumulative discount factor and the Present Value of Free Cash Flows.

The company's Implied Value will increase because the cash flows arrive earlier, and money today is worth more than money tomorrow.

Witness our Steel Dynamics analysis before and after making this change:

BEFORE:

Discount Period:	#	1	2	3	4	5
Discount Rate (WACC):	%	9.88%	9.88%	9.88%	9.88%	9.88%
Cumulative Discount Factor:	#	0.910	0.828	0.754	0.686	0.624
PV of Unlevered FCF:		$ 215.1	$ 215.7	$ 212.1	$ 232.3	$ 234.4

AFTER:

Discount Period:	#	0.5	1.5	2.5	3.5	4.5
Discount Rate (WACC):	%	9.88%	9.88%	9.88%	9.88%	9.88%
Cumulative Discount Factor:	#	0.954	0.868	0.790	0.719	0.655
PV of Unlevered FCF:		$ 225.5	$ 226.1	$ 222.3	$ 243.5	$ 245.7

The PV of each Unlevered Free Cash Flow increases because it's **generated earlier**.

There's a trickier feature that results from timing differences as well: **Stub periods**.

When you value a company on a specific date, **much of its cash flow for the year has already been generated** (unless you're valuing it on January 1st).

So you have to reduce the *projected* cash flow for the year by the amount that the company has *already* generated.

For example, if it's April 30th, the company is projected to generate $1,000 in FCF for the year, and it has *already* generated $300, you would subtract out that $300 and use $700 for the first period in a DCF.

But it's not as simple as just subtracting the already-generated cash flow – you also have to change the **discount periods** because April 30th to December 31st represents a fraction of a year, not an entire year.

This period from April 30th to December 31st is called the **stub period**.

To determine the discount period for this **stub period**, you take the remaining days of the year and divide by the total days in the year.

For example, if we're valuing a company on April 30th, there are 245 days until December 31st and 365 days in the year, assuming it's not a leap year.

Since 245 / 365 = 0.671, 0.671 will be the **discount period** for this first year.

The first discount period in a DCF will be 0.671 rather than 1.000, the next period will be 1.671 rather than 2.000, and the next one will be 2.671 rather than 3.000.

The *cash flows* in all the subsequent years will be the same because no cash flow for Year 2, 3, etc. has been generated as of April 30th of Year 1; you subtract cash flow only in the first period.

You can also combine the stub period with the mid-year convention.

If you do this, the first discount period will be the stub period fraction divided by 2.

Continuing with the April 30th example, dividing by 0.671 by 2 gives you 0.336.

By doing this, you're saying, "In the *remaining* time left in the year, let's assume that the cash flow arrives **midway** between **now** and the **end of the year**."

"Midway through the year" means on August 31st here.

In each period AFTER that first one, you take the normal discount period and subtract 0.5.

Here are the normal and mid-year discount periods for a valuation on April 30th, 2014:

	A	B	C	D	I	J	K	L	M
409									
410									
411			**Practice Exercises for Stub Periods and the Mid-Year Convention:**		**FY14**	**FY15**	**FY16**	**FY17**	**FY18**
412									
413			**1. Valuation Date of April 30th, 2014.**						
414									
415			Stub Period Fraction:	0.671					
416			Normal Discount Period:	*Year Fraction*	0.671	1.671	2.671	3.671	4.671
417			Mid-Year Discount Period:	*Year Fraction*	0.336	=+J416-0.5	2.171	3.171	4.171

Why not just keep dividing each "Normal Discount Period" by 2?

Because if you divide the FY15 "Normal Discount Period" by 2, you'd be saying that the cash flow arrives midway between April 30th, 2014, and December 31st, 2015.

In other words, you'd be saying that the *2015 cash flow* arrives on **March 1st, 2015**.

But that's not the case! If you assume the 2015 cash flow is evenly distributed, it should arrive on June 30th, 2015 – exactly midway through *that year*.

By using the correct discount period – 1.171 – for FY15, you're saying:

"Hey, today is April 30th, 2014. We don't get any 2015 cash flows in the year 2014, so let's add that whole stub period of 0.671. We do get cash flows in 2015, but they arrive midway through the year, so let's add 0.5 to reflect the fact that we get them midway through 2015. 0.671 + 0.500 = 1.171."

If you go out another year, you have to add 0.671 for the remainder of FY14, 1.000 for all of FY15 (since no 2016 cash flows arrive then), and then 0.500 for the cash flows that arrive midway through FY16.

That gives you 2.171 for the mid-year discount period.

The mid-year convention and stub periods impact the Present Value of a company's Free Cash Flows, but they also affect the **Terminal Value** and **PV of Terminal Value** calculations.

The PV of Terminal Value is easier to explain, so we'll start there: In an analysis with a 10-year explicit forecast period, you use the **Normal Discount Period** – *not* the Mid-Year Discount Period – to discount the Terminal Value to its Present Value.

So if this is 9.671 because of an April 30th valuation date, you'd use 9.671 rather than 10.000 in the PV of Terminal value formula.

But if you're not factoring in the stub period, and so the Normal Discount period is just 10.000, you'd use 10.000 to discount the Terminal Value.

Only stub periods affect this part – the mid-year convention does not because the Terminal Value should either account for the mid-year convention or ignore it altogether.

If you calculate the Terminal Value using the Multiples Method, the mid-year convention doesn't factor in because you apply the multiple to the company's full-year financial figures in the final year of the forecast period.

It's as if you're assuming the company **gets sold** at the *end of that year*, and, as a result, the fact that cash flows arrived midway through each year before that is irrelevant.

If you use the Gordon Growth Method, the same formula still applies, but you have to multiply the Terminal Value by (1+Discount_Rate)^0.5 to "move it back" to the very end of the last year in the forecast.

Making this adjustment lets you compare the Terminal Values produced by both methods.

If you did *not* do this, then you would have to discount each Terminal Value using a different period, which **we strongly recommend against**.

The Normalized Terminal Year

Even if you project only 10 years of a company's FCF, you may have to go **one year beyond that** because the final year may not be truly representative of the company into perpetuity.

For example:

- What if a **key patent expires** for a pharmaceutical company in Year 9 or 10?
- What if the company has a huge **Other Intangibles** balance that it's amortizing each year, but which goes away completely in Year 10?
- What if the company's planned **CapEx** or its expected **operating margins** will be very different after Year 10?
- What if the company's **FCF Growth** in Year 10 is very different from the range of Terminal FCF Growth Rates you've selected?

In all these cases, it's worthwhile to create a **Normalized Terminal Year** and then use the FCF from this year in the Terminal Value calculations.

Here's an example of a pharmaceutical company (Jazz) that suffers from these problems:

[Access the Rest of the IB Interview Guide]

Unlevered Free Cash Flow Projections:	Units:	Projected FY19	FY20	FY21	FY22	FY23	Normalized FY24
Revenue:	*$ M*	**$ 3,853.2**	**$ 4,552.3**	**$ 5,371.6**	**$ 1,662.1**	**$ 1,827.6**	**$ 1,919.0**
Annual Revenue Growth Rate:	*%*	*21.4%*	*18.1%*	*18.0%*	*(69.1%)*	*10.0%*	5.0%
Operating Income (EBIT):	*$ M*	2,044.0	2,424.9	2,870.7	739.4	825.0	964.2
Annual Operating Margin:	*%*	*53.0%*	*53.3%*	*53.4%*	*44.5%*	*45.1%*	45.0%
(-) Taxes, Excluding Effect of Interest:	*$ M*	(367.9)	(436.5)	(516.7)	(133.1)	(148.5)	(173.6)
Net Operating Profit After Tax (NOPAT):	*$ M*	**1,676.1**	**1,988.4**	**2,353.9**	**606.3**	**676.5**	**790.6**
Adjustments for Non-Cash Charges:							
Amortization of Intangible Assets:	*$ M*	100.7	100.7	100.7	100.7	100.7	-
Depreciation:	*$ M*	34.7	45.5	59.1	19.9	23.8	24.9
Acquired In-Process Research & Development:	*$ M*	-	-	-	-	-	-
Change in Fair Value of Contingent Consideration:	*$ M*	-	-	-	-	-	-
Deferred Income Taxes:	*$ M*	-	-	-	-	-	-
Goodwill Impairment:	*$ M*	-	-	-	-	-	-
Other Items and Adjustments:	*$ M*	4.1	4.1	4.1	4.1	4.1	4.1
Total Adjustments for Non-Cash Charges:	*$ M*	**139.4**	**150.3**	**163.9**	**124.7**	**128.5**	**29.0**
Changes in Operating Assets & Liabilities:							
Accounts Receivable:	*$ M*	(103.6)	(108.0)	(127.5)	554.8	(26.8)	
Inventories:	*$ M*	(20.5)	(21.1)	(24.8)	112.1	(5.0)	
Prepaid Expenses & Other Current Assets:	*$ M*	(45.4)	(50.4)	(59.1)	245.1	(12.8)	
Other Non-Current Assets:	*$ M*	-	-	-	-	-	
Accounts Payable:	*$ M*	16.1	16.6	19.5	(88.2)	3.9	
Accrued Liabilities:	*$ M*	63.2	70.1	82.3	(341.1)	17.8	
Income Taxes Payable:	*$ M*	-	-	-	-	-	
Deferred Revenue:	*$ M*	5.4	5.6	6.6	(29.7)	1.3	
Other Current & Non-Current Liabilities:	*$ M*	-	-	-	-	-	
Total Changes in Operating Assets & Liabilities:	*$ M*	**(84.7)**	**(87.2)**	**(103.0)**	**453.0**	**(21.5)**	**(11.0)**
% Change in Revenue:	*%*	*(12.5%)*	*(12.5%)*	*(12.6%)*	*(12.2%)*	*(13.0%)*	(12.0%)
(-) Capital Expenditures:	*$ M*	**(65.5)**	**(81.9)**	**(102.1)**	**(33.2)**	**(38.4)**	**(38.4)**
% Revenue:	*%*	*1.7%*	*1.8%*	*1.9%*	*2.0%*	*2.1%*	2.0%
Annual Unlevered Free Cash Flow:	*$ M*	**1,665.3**	**1,969.5**	**2,312.7**	**1,150.8**	**745.1**	**770.3**
Unlevered Free Cash Flow for Remaining Quarters:	*$ M*	**1,665.3**	**1,969.5**	**2,312.7**	**1,150.8**	**745.1**	**770.3**
Present Value of Free Cash Flow:	*$ M*	**1,117.0**	**1,222.4**	**1,328.2**	**611.6**	**366.4**	**350.5**
Normal Discount Period:	*Year Frac.*	5.647	6.647	7.647	8.647	9.647	10.647
Mid-Year Discount Period:	*Year Frac.*	5.147	6.147	7.147	8.147	9.147	10.147
Annual Free Cash Flow Growth Rate:	*%*	*20.7%*	*18.3%*	*17.4%*	*(50.2%)*	*(35.2%)*	*3.4%*

Much lower growth rate in-line with company's long-term prospects.

Lower margins to reflect less profitable divisions.

The company's Intangibles amortize completely in Year 10, so we leave them out of the non-cash adjustments.

Slightly lower figures for the Change in WC that better represent the company into perpetuity.

Most importantly, the FCF Growth Rate in the final year is now much closer to the Terminal Growth Rate.

As a result of this Normalized Terminal Year FCF, you no longer multiply the Year 10 FCF by (1 + Terminal FCF Growth Rate) to calculate the first Free Cash Flow in the Terminal Period – you use the FCF *in* this Normalized Terminal Year instead.

Creating a Normalized Terminal Year could make the company's Implied Value from a DCF higher or lower depending on your assumptions.

However, in *most* cases, the Normalized Terminal Year will reduce a company's Implied Value because you tend to adjust **down** the company's growth rate and margins in this year.

Net Operating Losses

Remember one of the key principles for calculating FCF and backing into the company's Implied Equity Value at the end:

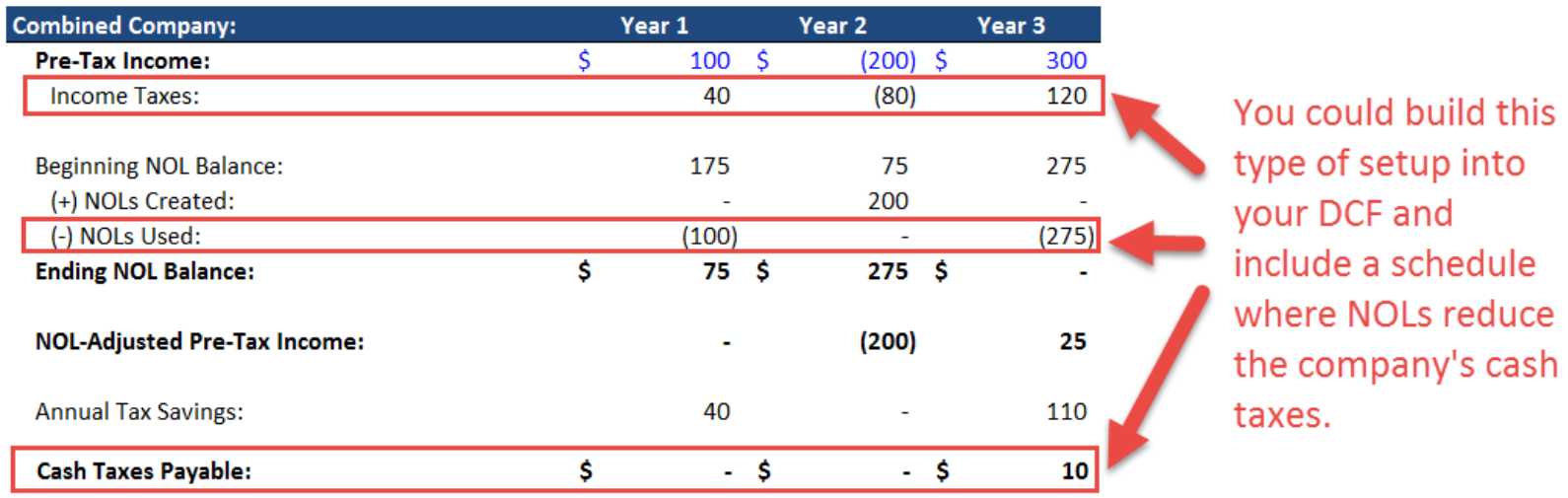
If you include an income or expense line item within Free Cash Flow, you should NOT factor in the corresponding Asset or Liability when going from Implied Enterprise Value to Implied Equity Value.

The opposite applies if you have *excluded* an income or expense line item from FCF.

So it's easiest to count **Net Operating Losses** as non-core-business Assets and add them when moving from Implied Enterprise Value to Implied Equity Value at the end.

But you could also make them reduce the company's cash taxes each year, similar to the setup in the lessons and guides on NOLs:

Combined Company:	Year 1	Year 2	Year 3
Pre-Tax Income:	$ 100	$ (200)	$ 300
Income Taxes:	40	(80)	120
Beginning NOL Balance:	175	75	275
(+) NOLs Created:	-	200	-
(-) NOLs Used:	(100)	-	(275)
Ending NOL Balance:	**$ 75**	**$ 275**	**$ -**
NOL-Adjusted Pre-Tax Income:	**-**	**(200)**	**25**
Annual Tax Savings:	40	-	110
Cash Taxes Payable:	**$ -**	**$ -**	**$ 10**



You'd have to create a separate schedule and then record a *positive* entry under Deferred Income Taxes since the company's cash flow increases when NOLs are applied.

We **strongly recommend against this setup** for a few reasons:

1) **What if the NOLs haven't been used up by the end of the forecast period?** You'll run into problems because the FCF projections alone won't capture their full value.

2) **It takes more work** to set up the analysis this way, and it doesn't add much since the Balance Sheet value of the NOLs represents their future tax savings anyway.

3) **If the company has negative Pre-Tax Income**, that would create extra NOLs and would increase the chances of the full NOL balance *not* being utilized by the end.

Noncontrolling Interests and Equity Investments

Leave both these items **out** of the FCF projections.

Doing anything else is the equivalent of torturing yourself for fun.

Yes, you could follow the inclusion/exclusion principle and include Net Income Attributable to Noncontrolling Interests and Net Income from Equity Investments in FCF, and then leave Noncontrolling Interests and Equity Investments *out* of the Enterprise Value to Equity Value calculation…

…But think of the challenges that presents:

- In an **Unlevered analysis**, you'd have to reverse the partially-owned companies' taxes, net interest expense, and other income/expense so you can determine their EBITs, and then subtract or add the relevant percentage of their EBITs.

- And most companies don't **disclose** close to enough information to do that.

- This process would be much easier in a Levered DCF (see the next section), but analysis presents many other problems, such as the fact that no one agrees on how to calculate Levered FCF.

The Bottom Line: Noncontrolling Interests and Equity Investments should **not** affect the company's Unlevered FCF at all. Just include them at the end when moving from Implied Enterprise Value to Implied Equity Value.

The Levered DCF, Adjusted Present Value (APV), and Other Variations

Just like there's both Unlevered FCF and Levered FCF, there are also Unlevered DCF and Levered DCF analyses.

The differences are as follows:

- You use **Levered FCF** instead of Unlevered FCF, which we define as Net Income + Primarily D&A Plus Potentially Other Non-Cash Adjustments +/- Change in Working Capital – Capital Expenditures – Mandatory Debt Principal Repayments.

- You use **Cost of Equity** for the Discount Rate.
- When you calculate Terminal Value using the Multiples Method, you should use **Equity Value-based multiples**, such as P / E.
- You **don't** have to back into Implied Equity Value at the end because the analysis produces Implied Equity Value.

We strongly recommend against using a Levered DCF unless someone has *specifically* asked you to build one.

Here are the problems with it:

1) It takes **more time and effort** to build because you have to project the company's Cash and Debt balances, net interest expense, and mandatory Debt principal repayments.
2) The FCF numbers are more **volatile** than the ones produced by an Unlevered DCF because Debt principal repayments can be $0 in some years and massive in others.
3) You will **NOT** get the same results from a Levered DCF analysis because it factors in the interest rate on Debt, whereas the Unlevered one does not.
4) No one can agree on how to **calculate Levered FCF**: Some people factor in *all* Debt issuances and repayments, some factor in *all* repayments but no issuances, and some factor in *only* mandatory repayments.

An Unlevered DCF is easier to set up, less time-consuming, less ambiguous, and produces more consistent numbers.

There are a few specialized cases where a Levered DCF is helpful; for example, you might use it in a restructuring/bankruptcy scenario when the percentage the equity investors might recover is significantly different from what the Debt investors might recover.

You might also use a Levered DCF for real estate investment trusts (REITs) because they are constantly issuing Equity and issuing and repaying Debt to fund their operations.

A Levered DCF is also important in fields such as Project Finance and Infrastructure where the Debt investors might want to see how much the project might be worth to Equity investors if something goes horribly wrong.

A related concept is the **Adjusted Present Value (APV)** analysis. It's similar to an *Unlevered* DCF, but it values the tax shield from a company's Debt and then adds the value of that tax shield to the company's Implied Enterprise Value.

You still calculate Unlevered Free Cash Flow and Terminal Value in the same way, but a few parts change:

- **Discount Rate:** You use the *Unlevered* Cost of Equity instead of WACC or the normal Cost of Equity. To do this, you un-lever Beta from the peer companies and take the median, but you do **not** re-lever Beta.

- **Interest Tax Shield:** You project the company's Net Interest Expense and multiply it by the Tax Rate to determine the tax savings from interest. But you also have to make sure this number is *less than* the total amount of Taxes in the EBIT → NOPAT calculation.

  If it's not, you use that total tax number instead and use the excess interest tax shield to offset *future* taxable income.

- **Discount Rate for Interest Tax Shield:** Once again, you use the Unlevered Cost of Equity.

- **Interest Tax Shield Terminal Value:** You calculate the Terminal Value of the Interest Tax Shield with Tax Rate * Debt in Terminal Year * Unlevered Cost of Equity * (1 + Terminal FCF Growth Rate) / (Unlevered Cost of Equity – Terminal FCF Growth Rate)^2

We're not going to cover the derivation, but that formula says that the value of the future benefits from the Tax Shield is proportional to the company's Tax Rate, Debt, and how quickly its cash flows are growing relative to the Discount Rate.

You sum up the Present Value of the Unlevered FCFs, the PV of Terminal Value, the PV of Interest Tax Shields, and the PV of the Terminal Value of the Interest Tax Shield to get the company's "Adjusted Present Value," which is another version of its Implied Enterprise Value.

Some people argue that that the APV method produces "more accurate results" because it takes into account the interest rate on Debt.

That is true in a general sense, but there are numerous problems with the APV analysis that explain why you rarely use it in real life:

- **No Downside for Debt:** It's incorrect to factor in only the *benefits* of Debt without also factoring in the major downside: The increased risk of bankruptcy. You could add this

risk to the APV analysis, but no one agrees on how to estimate the probability of bankruptcy.

- **Overstated Values for Firms with High Debt Balances:** The APV method will produce high values for companies with very high Debt balances because of the Interest Tax Shield. But companies with Debt balances this high should see **REDUCED** values because the risk of bankruptcy outweighs the tax benefits of Debt at that stage.

- **The Requirement to Project Interest Expense:** It takes extra time and effort to forecast the company's Interest Expense because you have to project how its Debt and Cash balances will change over time.

While the traditional approach using WACC has its flaws, using WACC for the Discount Rate accounts for **both** the tax benefits of Debt and the added bankruptcy risk.

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Key Rule #7: Comparable Public Companies (Public Comps)

"Valuation" refers to the **discounted cash flow (DCF) analysis**.

The other valuation methodologies, such as comparable public companies and precedent transactions, are just **shorthand for valuation**.

Instead of projecting and analyzing a company's cash flows, you compare the company to other, similar companies (or companies that were acquired) and use the valuation multiples from *those* companies to value the one you're looking at.

Even though these methodologies are less rigorous theoretically, they are still useful because they let you cross-check your results from the DCF analysis.

Also, in some sectors, such early-stage tech startups, the DCF is less relevant because it requires too much guesswork about far-in-the-future events.

To use comparable public companies to value a company, the process is as follows:

1) **Select** the appropriate set of comparable companies.
2) **Determine** the metrics and multiples you want to use.
3) **Calculate** the metrics and multiples for all the companies.
4) **Apply** the median (or 25th or 75th percentile, or other) multiples to *your* company to estimate its Implied Enterprise Value and Implied Equity Value.

Here's each step in detail:

1) Select the Appropriate Set of Comparable Companies

You normally start with a broad set of companies and then narrow it based on **industry**, **geography**, and **size**.

You could get the names of companies from Google Finance, Capital IQ, equity research, or even a company's filings where it lists its competitors.

So if you're valuing Steel Dynamics, you might start by looking at all steel manufacturing companies in the world.

But there are hundreds of companies worldwide, so you have to screen based on geography, industry, and size to get a set that's more similar.

A set of **5-10 companies** is a good target – you don't want 50 companies because they won't all be comparable, but you also don't want only 1-2 companies because the data will be too limited to be useful.

For Steel Dynamics, we used this screen:

- **Geography:** U.S.
- **Industry:** Steel Manufacturers
- **Size:** Projected revenue between $1 billion and $20 billion USD

Comparable Companies - U.S.-Based Steel Manufacturer Companies with FY16 Projected Revenue Between $1 Billion and $20 Billion
($ USD in Millions Except Per Share Amounts in USD as Stated)

Geographic, industry, and size screen.

Operating Statistics:	Capitalization		Revenue			EBITDA		
Company Name	Equity Value	Enterprise Value	LTM	FY16	FY17	LTM	FY16	FY17
United States Steel Corp.	$ 3,130.1	$ 5,451.1	$ 10,327.0	$ 10,545.2	$ 11,231.3	$ (128.0)	$ 675.0	$ 921.4
Nucor Corporation	15,609.0	17,982.3	15,643.6	16,684.8	16,937.1	1,972.9	2,291.4	2,539.6
Commercial Metals Company	1,776.7	2,373.0	4,813.4	4,683.9	4,780.1	431.9	367.4	423.1
AK Steel Holding Corporation	1,036.2	3,437.7	6,263.6	5,991.8	6,108.2	547.2	469.2	580.9
Worthington Industries, Inc.	2,732.3	3,358.5	2,819.7	2,891.3	2,971.4	239.9	281.5	324.1
Reliance Steel & Aluminum Co.	5,259.1	7,340.6	8,679.0	8,890.4	9,303.6	784.6	850.7	928.7
Maximum	$ 15,609.0	$ 17,982.3	$ 15,643.6	$ 16,684.8	$ 16,937.1	$ 1,972.9	$ 2,291.4	$ 2,539.6
75th Percentile	4,726.9	6,868.3	9,915.0	10,131.5	10,749.3	725.3	806.8	926.9
Median	**$ 2,931.2**	**$ 4,444.4**	**$ 7,471.3**	**$ 7,441.1**	**$ 7,705.9**	**$ 489.6**	**$ 572.1**	**$ 751.1**
25th Percentile	2,015.6	3,378.3	5,176.0	5,010.9	5,112.1	287.9	392.9	462.6
Minimum	1,036.2	2,373.0	2,819.7	2,891.3	2,971.4	(128.0)	281.5	324.1
Steel Dynamics Inc.	**$ 6,043.2**	**$ 7,501.1**	**$ 7,307.2**	**$ 7,716.0**	**$ 8,406.2**	**$ 862.8**	**$ 626.4**	**$ 730.2**

Six companies in the set is a good result; you usually want between 5 and 10 companies.

This screen is important because you want these companies to have similar DISCOUNT RATES.

As always, it goes back to my favorite formula:

Company Value = Cash Flow / (Discount Rate – Cash Flow Growth Rate)

If two companies are very similar, but one trades at higher multiples, its expected Cash Flow Growth Rate is higher.

But that's true ONLY if the companies are similar in terms of size and Discount Rate.

In this example with Steel Dynamics, we can look at the 6 companies and say: "They're all about the same size and are in the same industry, so their Discount Rates are similar. So we can conclude that companies with higher multiples have higher expected growth rates."

But if the companies were very different, we would not be able to draw that conclusion.

When the companies are quite different, the link between expected cash flow growth and valuation multiples breaks down.

There are few hard-and-fast rules for screening companies; if you can't get enough companies in your set, you have to expand the screening criteria, and if you get too many, you have to narrow it.

In large countries such as the U.S., China, and India, there are often so many domestic companies that the geographic screen be *just* that country.

But if your company is in a small European country like Estonia or Finland, you'll almost certainly have to use a European-wide geographic screen to get enough companies in the set.

The same logic applies to the industry screen: Make it as specific as possible, but if you get a set with only 1-2 companies, broaden it.

For example, let's say that you're valuing a niche Software-as-a-Service (SaaS) company such as **Fleetmatics**, which provides software for GPS tracking and vehicle fleet management.

You couldn't make the industry screen "SaaS companies providing transportation and logistics software" because there might not **BE** any other public companies doing that.

Even if there are 1-2 other companies, the screen is still too specific to be useful.

So you'd probably expand it and use "Software as a Service Companies" for the industry screen, and then narrow the companies based on financial criteria.

With the financial criteria, you can screen by metrics such as revenue, EBITDA, or FCF, but you should **avoid** screening by *both* financial metrics and Equity Value or Enterprise Value.

For example, you should **NOT** use this screen: "Companies with revenue under $1 billion and Enterprise Values above $2 billion."

If you do that, you're **artificially constraining the multiples** because EV / Revenue must be above 2x for every company in the set.

Even screening by Equity Value or Enterprise Value alone is questionable because you're constraining the valuations. So it's **best** to create financial screens based on metrics like revenue, EBITDA, or FCF.

2) Determine the Metrics and Multiples You Want to Use

There isn't much to say here because we covered the trade-offs of different metrics and multiples in the previous section/guides on Equity Value and Enterprise Value.

In *most* industries, you'll look at 1 sales-based metric (and corresponding multiple) and 2 profitability-based metrics (and corresponding multiples).

For example, the following set of metrics and multiples is common in many industries:

- **Revenue**, EV / Revenue, and Revenue Growth
- **EBITDA**, EV / EBITDA, and EBITDA Growth and Margins
- **Net Income**, P / E, and Net Income Growth and Margins

There is no "best" metric or multiple. Each one has its strengths and weaknesses, such as the fact that P / E multiples are affected by capital structure.

Sometimes, you'll exclude Revenue-based metrics and multiples and focus more on the profitability-related ones, such as EBITDA, EBIT, and Net Income.

And if you're in an industry with significantly different metrics and multiples, such as commercial banks, you'll use the metrics that are important there (e.g., P / BV, P / E, Total Assets, ROE, etc.).

One new point is that **the time periods** matter a lot.

Specifically, you can look at a company's *historical* Revenue or EBITDA that it earned last year or in the past 12 months, but you can also look at its *projected* Revenue or EBITDA for the next 12 months or next calendar year.

You almost always use a mix of historical and projected metrics. Often, you'll use 1 historical version and 2 projected versions of each metric.

For example, if the valuation date is June 30th, 2025, you might use these 3 figures for revenue for a comparable company:

- **Last Twelve Months (LTM) Revenue:** This is the company's revenue between June 30th, 2024, and June 30th, 2025; it's based on **what happened in real life**.

- **2025 Projected Revenue:** This is what the market expects the company to earn in revenue for this entire year. So it's partially based on what happened in the first half of this year, but also on what's *expected* to happen in the second half.

- **2026 Projected Revenue:** This is what the market expects the company to earn in revenue for *next* year. This one is based 100% on **expectations** since the next year hasn't started yet.

Historical metrics are useful because they're based on actual events, but they can also be deceptive if there were non-recurring items or if the company made acquisitions.

Projected metrics are useful because they assume the company will operate in a "steady state," without acquisitions or non-recurring items, but they're also less reliable because they're based on predictions of the future.

So there is no "best" version; each one has different trade-offs, and you look at multiple versions of each metric to get the full picture.

3) Calculate the Metrics and Multiples for All the Companies

Since you use only **public companies** (hence the name), the calculations are straightforward.

You calculate each company's **Current Equity Value** and **Current Enterprise Value** based on their current share prices, shares outstanding, and most recent Balance Sheets.

You should already know how to do that from the last sections/guides on Equity Value and Enterprise Value.

Then, you retrieve the historical figures for revenue, EBITDA, Net Income, and any other metrics you're using by going through the company's annual and quarterly reports and looking at the Income Statements and Cash Flow Statements there.

To calculate the LTM figures, you take the previous fiscal year's numbers, add the figures from the most recent "partial period," and subtract the figures from the same "partial period" in the previous year.

Example: You want to calculate a company's LTM revenue as of June 30th, 2025. If the company's fiscal year ends on December 31st, you would:

1. Start with the revenue on its Income Statement for the full year 2024, i.e. what the company has earned between January 1st, 2024 and December 31st, 2024.

2. Then, add the revenue for the 6 months from January 1st, 2025 through June 30th, 2025.

3. Then, subtract the revenue for the 6 months between January 1st, 2024 and June 30th, 2024.

If the company has **non-recurring charges** that affect its metrics – Restructuring, Write-Downs, Legal Expenses, Goodwill Impairment, etc. – then you'll add them back when calculating these metrics.

Use extreme caution when doing so because many of these charges are not, in fact, non-recurring.

For example, many companies are always "restructuring," but pretend that Restructuring Expenses are unusual one-time events.

But if the expense occurs frequently (say, 2-3 years in the past 5 years), it should **not** count as non-recurring.

Once you calculate the historical versions of these metrics, you have to find the **projected figures**.

You do **NOT** make your own projections for each comparable company because the point of the analysis is to use each company's **CURRENT** Value and **CURRENT** valuation multiples.

So you use what the *market as a whole* thinks about each company.

You can find these figures in equity research reports issued by banks, or you can look up consensus estimates on Bloomberg, Capital IQ, or other finance news sources.

One issue with projected metrics is that **comparable companies often have fiscal years that end on different dates**.

For example, one company's fiscal year ends on June 30th but another company's fiscal year ends on September 30th.

When that happens, you **"calendarize"** the figures so that the metrics line up.

The full explanation for calendarization is beyond the scope of this guide (see the related lessons in the modeling courses), but at a high level, you add and subtract quarters or half-year periods until you get matching figures.

For example, if it's a June 30th vs. September 30th mismatch, you could make each projected year for the June 30th company match up by:

- Taking the *full fiscal-year projections* (i.e., the numbers from July 1st to June 30th in a future year).
- **Adding** the first quarter of the *next* fiscal year after that (June 30th to September 30th).
- And then **subtracting** that same period (June 30th to September 30th) from the prior fiscal year.

Sometimes you can't get an exact match – if one company's fiscal year ends on April 30th and another's ends on June 30th, for example – so you might multiply the financial metrics by fractions to make the projections match up.

Often, you calendarize to make the comparable companies' fiscal years **match the fiscal year of the company you are valuing**.

So if the company's fiscal year ends on December 31st, and other companies in the set have fiscal years that end on June 30th and September 30th, you'll change the other companies to use calendar-year figures (i.e., the year ending December 31st).

But if *every* company in the set has a fiscal year ending on June 30th, and your company's ends on December 31st, then you might just change your company to match the rest.

One Final Note: For both historical and projected metrics, you **ALWAYS** use the company's **Current Equity Value** or **Current Enterprise Value** to calculate the valuation multiples.

So you don't "project" Equity Value or Enterprise Value.

So if a company is growing, its multiples should **decline** into the future. Maybe its LTM Revenue is $1,000, its Year 1 Projected Revenue is $1,200, and its Year 2 Projected Revenue is $1,500.

If its Current Enterprise Value is $2,000, then its EV / Revenue multiples are 2x for the LTM period, 1.7x for Year 1, and 1.3x for Year 2.

You don't project Equity Value or Enterprise Value because **a company's share price already reflects its historical performance and expectations for future performance**.

To project these items, you'd have to time travel to the future, see what expectations are at *that* point in the future, and then time travel back to the present.

So if you can travel faster than the speed of light and break all known laws of physics, feel free to project Equity Value and Enterprise Value; otherwise, though, always use the **Current** values for both.

Here's what our set of comparable public companies for Steel Dynamics:

Operating Statistics:	Capitalization		Revenue			EBITDA			Net Income			Projected Revenue	Projected EBITDA	EBITDA Margin		
Company Name	Equity Value	Enterprise Value	LTM	FY16	FY17	LTM	FY16	FY17	LTM	FY16	FY17	Growth	Growth	LTM	FY16	FY17
United States Steel Corp.	$ 3,130.1	$ 5,451.1	$ 10,327.0	$ 10,545.2	$ 11,231.3	$ (128.0)	$ 675.0	$ 921.4	$ (1,692.0)	$ (74.9)	$ 333.8	6.5%	36.5%	(1.2%)	6.4%	8.2%
Nucor Corporation	15,609.0	17,982.3	15,643.6	16,684.8	16,937.1	1,972.9	2,291.4	2,539.6	469.6	818.3	1,001.0	1.5%	10.8%	12.6%	13.7%	15.0%
Commercial Metals Company	1,776.7	2,373.0	4,813.4	4,683.9	4,780.1	431.9	367.4	423.1	129.4	127.4	171.5	2.1%	15.2%	9.0%	7.8%	8.9%
AK Steel Holding Corporation	1,036.2	3,437.7	6,263.6	5,991.8	6,108.2	547.2	469.2	580.9	(135.0)	57.3	128.9	1.9%	23.8%	8.7%	7.8%	9.5%
Worthington Industries, Inc.	2,732.3	3,358.5	2,819.7	2,891.3	2,971.4	239.9	281.5	324.1	143.7	177.4	220.3	2.8%	15.1%	8.5%	9.7%	10.9%
Reliance Steel & Aluminum Co.	5,259.1	7,340.6	8,679.0	8,890.4	9,303.6	784.6	850.7	928.7	313.1	390.2	441.6	4.6%	9.2%	9.0%	9.6%	10.0%
Maximum	$ 15,609.0	$ 17,982.3	$ 15,643.6	$ 16,684.8	$ 16,937.1	$ 1,972.9	$ 2,291.4	$ 2,539.6	$ [illegible]	$ 818.3	$ 1,001.0	6.5%	36.5%	12.6%	13.7%	15.0%
75th Percentile	4,726.9	6,868.3	9,915.0	10,131.5	10,749.3	725.3	806.8	926.9	270.8	337.0	414.6	4.2%	21.6%	9.0%	9.7%	10.7%
Median	**$ 2,931.2**	**$ 4,444.4**	**$ 7,471.3**	**$ 7,441.1**	**$ 7,705.9**	**$ 489.6**	**$ 572.1**	**$ 751.1**	**$ 136.6**	**$ 152.4**	**$ 277.0**	**2.4%**	**15.1%**	**8.9%**	**8.7%**	**9.7%**
25th Percentile	2,015.6	3,378.3	5,176.0	5,010.9	5,112.1	287.9	392.9	462.6	(68.9)	[illegible]	183.7	2.0%	11.9%	8.6%	7.8%	9.0%
Minimum	1,036.2	2,373.0	2,819.7	2,891.3	2,971.4	(128.0)	281.5	324.1	(1,692.0)	(74.[illegible]	128.9	1.5%	9.2%	(1.2%)	6.4%	8.2%
Steel Dynamics Inc.	**$ 6,043.2**	**$ 7,501.1**	**$ 7,307.2**	**$ 7,716.0**	**$ 8,406.2**	**$ 862.8**	**$ 626.4**	**$ 730.2**	**$ 12.1**	**$ 170.7**	**$ [illegible]205.8**	**8.9%**	**16.6%**	**11.8%**	**8.1%**	**8.7%**

Valuation Statistics:	Capitalization		Enterprise Value / Revenue			Enterprise Value / EBITDA			P / E Multiple		
Company Name	Equity Value	Enterprise Value	LTM	FY16	FY17	LTM	FY16	FY17	LTM	FY16	FY17
United States Steel Corp.	$ 3,130.1	$ 5,451.1	0.5 x	0.5 x	0.5 x	NM	8.1 x	5.9 x	NM	NM	9.4 x
Nucor Corporation	15,609.0	17,982.3	1.1 x	1.1 x	1.1 x	9.1 x	7.8 x	7.1 x	33.2 x	19.1 x	[illegible]
Commercial Metals Company	1,776.7	2,373.0	0.5 x	0.5 x	0.5 x	5.5 x	6.5 x	5.6 x	13.7 x	[illegible]	10.4 x
AK Steel Holding Corporation	1,036.2	3,437.7	0.5 x	0.6 x	0.6 x	6.3 x	7.3 x	5.9 x	NM	18.1 x	8.0 x
Worthington Industries, Inc.	2,732.3	3,358.5	1.2 x	1.2 x	1.1 x	14.0 x	11.9 x	10.4 x	19.0 x	15.4 x	12.4 x
Reliance Steel & Aluminum Co.	5,259.1	7,340.6	0.8 x	0.8 x	0.8 x	9.4 x	8.6 x	7.9 x	16.8 x	13.5 x	11.9 x
Maximum	$ 15,609.0	$ 17,982.3	1.2 x	1.2 x	1.1 x	14.0 x	11.9 x	10.4 x	33.2 x	19.1 x	15.6 x
75th Percentile	4,726.9	6,868.3	1.1 x	1.0 x	1.0 x	9.4 x	8.5 x	7.7 x	22.6 x	18.1 x	12.3 x
Median	**$ 2,931.2**	**$ 4,444.4**	**0.7 x**	**0.7 x**	**0.7 x**	**9.1 x**	**8.0 x**	**6.5 x**	**17.9 x**	**15.4 x**	**11.1 x**
25th Percentile	2,015.6	3,378.3	0.5 x	0.5 x	0.5 x	6.3 x	7.5 x	5.9 x	16.0 x	13.9 x	9.6 x
Minimum	1,036.2	2,373.0	0.5 x	0.5 x	0.5 x	5.5 x	6.5 x	5.6 x	13.7 x	13.5 x	8.0 x
Steel Dynamics Inc.	**$ 6,043**	**$ 7,501**	**1.0 x**	**1.0 x**	**0.9 x**	**8.7 x**	**12.0 x**	**10.3 x**	**NM**	**35.4 x**	**29.4 x**

Notice how the multiples **DECLINE** over time because we use the same Equity Value and Enterprise Value, but the company's Revenue and EBITDA grow each year.

If the multiples do **not** decline, it means the underlying metrics have stayed the same or shrunk.

4) Apply the Multiples to Your Company

This part is simple: You calculate the minimum, 25th percentile, median, 75th percentile, and maximum for each version of each multiple (see the diagram above), and then you apply those multiples to your company to value it.

Example: The median LTM EV / EBITDA multiple for the comparable companies is 12x. The LTM EBITDA of the company you're valuing is $500 million. Therefore, your company's *Implied Enterprise Value* based on the LTM EV / EBITDA of the public comps is 12 * $500 million, or $6 billion.

You repeat this same process for all the multiples, and then you back into the company's Implied Equity Value and Implied Share Price (for public companies) for each one:

Valuation Summary - Steel Dynamics Inc.	Steel Dynamics Inc. - Range of Valuation Multiples / Premiums						Steel Dynamics Inc. - Implied Per Share Value Range				
Methodology Name	Maximum Multiple	75th Percentile Multiple	Median Multiple	25th Percentile Multiple	Minimum Multiple	Applicable Company Figure	Minimum Multiple	25th Percentile Multiple	Median Multiple	75th Percentile Multiple	Maximum Multiple
Public Company Comparables:											
LTM EV / Revenue:	1.2 x	1.1 x	0.7 x	0.5 x	0.5 x	$ 7,307.2	$ 8.86	$ 10.07	$ 15.03	$ 26.39	$ 29.94
FY 16 EV / Revenue:	1.2 x	1.0 x	0.7 x	0.5 x	0.5 x	7,716.0	10.13	10.91	16.28	26.33	31.01
FY 17 EV / Revenue:	1.1 x	1.0 x	0.7 x	0.5 x	0.5 x	8,406.2	10.53	11.80	17.45	28.49	33.24
LTM EV / EBITDA:	14.0 x	9.4 x	9.1 x	6.3 x	5.5 x	862.8	14.56	16.37	26.47	27.33	43.89
FY 16 EV / EBITDA:	11.9 x	8.5 x	8.0 x	7.5 x	6.5 x	626.4	10.69	13.27	14.58	15.95	24.85
FY 17 EV / EBITDA:	10.4 x	7.7 x	6.5 x	5.9 x	5.6 x	730.2	10.90	11.83	13.59	17.20	25.25
LTM P / E:	33.2 x	22.6 x	17.9 x	16.0 x	13.7 x	12.1	0.69	0.80	0.90	1.13	1.66
FY 16 P / E:	19.1 x	18.1 x	15.4 x	13.9 x	13.5 x	170.7	9.51	9.84	10.87	12.76	13.46
FY 17 P / E:	15.6 x	12.3 x	11.1 x	9.6 x	8.0 x	205.8	6.84	8.18	9.47	10.44	13.26

To calculate Steel Dynamics' Implied Share Price at the 25th percentile LTM EV / Revenue multiple, you multiply 0.5x by $7,307.2, its LTM Revenue. That gives you its Implied Enterprise Value of $3,895.4.

Then, you back into the Implied Equity Value by adding non-core-business Assets and subtracting L&E items that represent different investor groups, and you divide by the share count to calculate the company's Implied Share Price.

You complete this process because you want to get a **range of Implied Values for the company**.

No one ever knows *exactly* how much a company is worth – it's stupid to make a statement like "Steel Dynamics is worth exactly $23.51 per share!"

Instead, the goal is to say: "Steel Dynamics might be worth between $15.00 and $20.00 per share according to revenue multiples, or between $17.00 and $23.00 per share according to EBITDA multiples."

Even though the mechanics are simple, **the big idea** may not be obvious.

With Public Comps, you are calculating the company's **Implied Value** by using the **Current Values** of other, similar companies.

So *unlike* in a DCF, where your views of the company's revenue, expenses, and cash flow explain the company's Implied Value, *the market as a whole* explains the Implied Value here.

That's why Public Comps are a "relative valuation methodology" – you use market data, so the company's Implied Value is based on the values of *other* companies.

You should now understand one of the major downsides of Public Comps: **What if the market is completely wrong?**

It happens all the time – just ask anyone who bought a stock right before the price crashed by 30% in a day!

For this reason, you should consider relative valuation methodologies **"supplemental."**

You'll almost always use them, and they can help confirm or deny the results of your DCF analysis, but ultimately **the discounted cash flow analysis IS valuation**.

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Key Rule #8: Precedent Transactions (M&A Comps)

Almost everything in the section above on Comparable Public Companies also applies to **Precedent Transactions**.

The main difference is that with this methodology, you calculate valuation multiples based on what **acquirers have paid to acquire other companies**, not what those companies' shares are currently trading at on the stock market.

Here are the **key differences** in this methodology:

- **Screening Criteria:** You still screen by **industry**, **geography**, and **size**, but each one is based on *the seller*. So if the geographic screen is U.S.-based companies, it's fine to use a deal with a U.S. seller and a Japanese buyer.

  One additional criterion is **time**. The M&A market changes greatly over time, and so multiples that were accurate 10 years ago might be ridiculous today. Often, you look at transactions from only the past 2 or 3 years, and sometimes up to 5 years. Going back 10 years is almost always too far in the past to be useful.

  For the financial criteria, you often use **Transaction Size** (either Enterprise Value or Equity Value) rather than revenue or EBITDA. It's more acceptable to screen by those metrics because deals of very different sizes might not be comparable at all.

  Finally, you often use **broader** screening criteria with M&A deals because there may not *be* enough deals if you use narrow criteria.

- **Metrics and Multiples:** You still look at both sales-based and profitability-based metrics and multiples, but you focus more on **historical metrics and multiples** – LTM Revenue and LTM EBITDA are the most common ones.

One reason is that it can be extremely difficult to find *projections* for acquired companies *as of the time they were acquired*. Another reason is that the data tends to be more inconsistent because companies can be acquired for many different reasons, both logical and nonsensical.

So you use a shorter, simpler set of metrics and multiples: You might just list the acquirer's name, target's name, purchase price, announcement date, LTM Revenue and EBITDA, and LTM EV / Revenue and EV / EBITDA.

- **Calculations of Metrics and Multiples:** With Precedent Transactions, everything is based on the **purchase price as of the announcement date of the deal**. So the LTM figures are based on the most recent data that was available *at the time the deal was announced*.

  Example: The company has 100 shares outstanding, and its share price is $10.00. An acquirer announces plans to buy the company for $15.00 / share. Therefore, you would use 100 * $15.00, or $1,500, for the company's **Transaction Equity Value**, and you would move to the Transaction Enterprise Value in the same way as usual, using the company's most recent Balance Sheet available as of the time of the deal.

  If this transaction is announced on May 15th, the most recent financial figures are likely from the quarter ending March 31st, so you would use those and create LTM figures based on the March 31st period. If the transaction is announced on July 5th, the June 30th results will not be available for another few weeks, so you would *still* use the March 31st results for the LTM figures.

  You don't need to worry about calendarization too much because you'll almost always use only LTM metrics and multiples. The same points about non-recurring charges apply: Yes, add them back, but only if they *are* non-recurring.

- **Output:** You get the same output from Precedent Transactions that you do from Public Comps: The minimum, 25th percentile, median, 75th percentile, and maximum for each version of each multiple.

  The difference is that the data tends to be **less consistent** because companies get acquired for *very* different reasons. A "strategic acquirer" (i.e., a normal company)

might pay a ridiculous amount because the CEO is having an affair with the CEO of the target company, or because the VP of Product likes one of the seller's products.

But a private equity acquirer might take a more scientific approach and pay based only on the company's financial value.

Often, the multiples produced by Precedent Transactions are **higher** than those from Public Comps because of the **control premium** built into M&A deals.

To acquire 100% of another company, the buyer has to offer a **premium** to the other company's Current Share Price. If the company's shares are trading at $10.00, why would it ever sell itself for only $10.00 per share? Investors could get that price in the market by selling their shares individually!

So the acquirer might have to offer $12.00 per share or $15.00 per share to do the deal. This "extra amount" above the seller's Current Share Price is the **control premium**.

Control premiums vary based on industry and geography, but they're often between **10% and 30%**. As a result, multiples from Precedent Transactions are often higher.

However, this isn't always true because Precedent Transactions also include acquisitions of private companies, the M&A market might be priced very differently from the public markets, or control premiums might be unusually high or low.

- **Transaction Structures and Other Points:** Ideally, you will use real **acquisitions** – deals where one company buys 100% of another company – in your valuation.

  In many cases, however, there won't be enough 100% acquisition deals, so you'll also have to use acquisitions for less than 100% of the other company.

  It's fine to use **majority-stake deals**, i.e. ones where the acquirer purchased at least 50% of the seller, but you should **NOT** mix and match minority and majority-stake deals.

  The dynamics are very different when one company purchases only 5% or 10% of the seller rather than 70%.

M&A deals can be structured in different ways, which also creates issues with Precedent Transactions.

For example, some deals have **earn-outs** where a portion of the purchase price is paid out several years into the future, but only if the seller meets certain financial goals.

The fact that some deals are **cash purchases** while others are **stock purchases** (i.e., the acquirer issues new shares to acquire the seller) also creates differences; companies are more likely to overpay in stock purchases because stock seems like "Monopoly Money."

Here's our set of Precedent Transactions for Steel Dynamics:

Precedent Transactions - North American Steel Manufacturer Sellers with Transaction Enterprise Values Above $500 Million USD

Announced Between January 1st, 2011 and September 2nd, 2016

($ USD in Millions Except Per Share Amounts in USD as Stated)

TIME is an additional screening criterion.

Steel Dynamics Inc. - Comparable M&A Transactions:						Valuation Multiples	
Acquirer Name	Target Name	Announcement Date	Transaction Enterprise Value	LTM Revenue	LTM EBITDA	EV / LTM Revenue	EV / LTM EBITDA
Ontario Steel Investment Limited	Essar Steel Algoma Inc.	2016-07-10	$ 903.0	$ 1,678.5	$ (42.0)	0.5 x	NM
BlueScope Steel Limited	North Star BlueScope Steel, LLC	2015-10-26	1,481.0	1,167.7	185.9	1.3 x	8.0 x
Nucor Corporation	Gallatin Steel Company	2014-09-15	770.0	N/A	N/A	N/A	N/A
Hitachi Metals, Ltd.	Waupaca Foundry, Inc.	2014-08-19	1,337.8	1,735.0	161.7	0.8 x	8.3 x
Steel Dynamics Inc.	Severstal Columbus, LLC	2014-07-21	1,625.0	1,938.6	144.7	0.8 x	11.2 x
AK Steel Corporation	Severstal Dearborn, Inc.	2014-07-21	707.0	2,018.1	24.0	0.4 x	29.4 x
Trinity Industries Inc.	Meyer Steel Structures	2014-06-27	600.0	199.8	31.39	3.0 x	19.1 x
ArcelorMittal and Nippon Steel & Sumitomo Metal Corporation	ThyssenKrupp Steel USA, LLC	2013-11-29	1,550.0	1,662.1	80.2	0.9 x	19.3 x
Reliance Steel & Aluminum Co.	Metals USA Holdings Corp.	2013-02-06	1,216.5	1,983.6	143.3	0.6 x	8.5 x
Nucor Corporation	Skyline Steel L.L.C.	2012-05-17	684.0	873.0	N/A	0.8 x	N/A
Winsway Coking Coal Holdings Limited & Marubeni Corporation	Grande Cache Coal Corporation	2011-10-31	1,028.4	289.0	74.2	3.6 x	13.9 x
	Maximum		$ 1,625.0	$ 2,018.1	$ 185.9	3.6 x	29.4 x
	75th Percentile		1,409.4	1,887.7	144.7	1.2 x	19.2 x
	Median		**$ 1,028.4**	**$ 1,670.3**	**$ 80.2**	**0.8 x**	**12.5 x**
	25th Percentile		738.5	946.7	31.4	0.7 x	8.4 x
	Minimum		600.0	199.8	(42.0)	0.4 x	8.0 x

We focus on historical (LTM) multiples.

Notice how these multiples are *higher* than the ones from the Public Comps (0.7x and 9.1x median LTM multiples there), as expected.

But the data is all more random, and the multiples span a much wider range.

The Bottom Line: Precedent Transactions are useful for valuing companies that lack good Public Comps or that have unpredictable cash flows.

However, we'd rate them as **less reliable and consistent** than the other methodologies because of all the issues above.

If you look at the examples of Precedent Transactions throughout our modeling courses, they often produce the most **random** output that spans the widest range of values.

You need to know about Precedent Transactions for interviews, and you'll almost always look at them in a valuation, but they are still less reliable and consistent than the other methodologies.

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Key Rule #9: Other Valuation Methodologies [OPTIONAL]

Besides the 3 main methodologies – the DCF analysis, Public Comps, and Precedent Transactions – there are a few others.

You are unlikely to get questions on these methodologies in interviews, so you can consider this section "Optional."

Asset-Based Valuations

Remember the definitions of Equity Value and Enterprise Value: They're both linked to a company's **Balance Sheet** because they relate to its core vs. non-core Assets and the Liability & Equity items that represent other investor groups vs. those that don't.

So you could skip this business with cash flows and multiples and simply **estimate the market values of the company's Assets and its Liabilities**.

You then subtract the market-valued Liabilities from the market-valued Assets to get the company's **Implied Equity Value**.

This method is called a **Liquidation Valuation**, but it also goes by other names, such as "Net Asset Value" model.

It produces the company's Implied Equity Value because you're valuing *all its Assets*, **not** just its core-business Assets, and you're not distinguishing between Liabilities that represent other investor groups and ones that don't.

This methodology seems nice in theory, but there are a few problems with it:

1) **It's difficult to determine the market values of everything**. There are some rules of thumb – for example, Cash is almost always worth 100% of its Book Value, and Goodwill is worth nothing – but to value an Asset like PP&E, you'd have to do a ton of data gathering.

2) **It tends to undervalue healthy, growing companies** because such companies are worth *more* than their Balance Sheets. If a company is distressed and about to collapse, its only real value comes from selling off its Assets. But healthy companies are worth a whole lot more.

Here's an example analysis for Yahoo:

Yahoo! Inc. - Liquidation Valuation					
		Assumed Recovery		Liquidation Value	
	Last FY	Low	High	Low	High
Assets					
Current Assets:					
Cash and Cash Equivalents:	$1,514	95.0%	100.0%	$1,438	$1,514
Short-Term Debt Investments:	$488	70.0%	90.0%	$341	$439
Accounts Receivable, Net:	$1,056	95.0%	100.0%	$1,003	$1,056
Prepaid Expenses & Other Current Assets:	$181	95.0%	100.0%	$172	$181
Total Current Assets:	**$3,238**			**$2,954**	**$3,189**
Long-Term Debt Investments:	$362	70.0%	90.0%	$253	$326
Net PP&E:	$1,332	90.0%	95.0%	$1,198	$1,265
Goodwill:	$4,002	0.0%	0.0%	$0	$0
Net Intangible Assets:	$611	0.0%	0.0%	$0	$0
Other Long-Term Assets:	$504	90.0%	95.0%	$454	$479
Investments in Equity Interests:	$2,181	N/A	N/A	$5,362	$5,362
Total Assets:	**$12,230**			**$10,222**	**$10,621**
Liabilities					
Current Liabilities:					
Accounts Payable:	$176			$176	$176
Accrued Expenses & Other Current Liabilities:	$1,006			$1,006	$1,006
Short-Term Deferred Revenue:	$368			$368	$368
Short-Term Debt:	$750			$750	$750
Total Current Liabilities:	**$2,300**			**$2,300**	**$2,300**
Long-Term Deferred Revenue:	$95			$95	$95
Long-Term Debt:	$0			$0	$0
Other Long-Term Liabilities:	$28			$28	$28
Deferred and Other Long-Term Tax Liabilities, Net:	$261			$261	$261
Commitments and Contingincies:	$0			$0	$0
Noncontrolling Interests	$12			$12	$12
Total Liabilities:	**$2,697**			**$2,697**	**$2,697**

Implied Equity Value:	**$7,525**	**$7,924**
Implied Share Price:	**$ 5.63**	**$ 5.93**

The Dividend Discount Model (DDM)

The DDM is an alternative to the DCF analysis that is critical in some industries (commercial banks and insurance), potentially important in a few other (utilities and some energy companies), and useless in most others (technology, healthcare, retail, etc.).

Instead of valuing a company by projecting its Unlevered Free Cash Flows and discounting them with WACC, you use its **Dividends** and **Cost of Equity** instead.

In a DDM, you typically project down to the company's Net Income, make Dividends a % of Net Income, and then calculate the Terminal Value based on a P / E multiple, just like in a Levered DCF.

The problem is that a DDM is only useful for companies that issue recurring, predictable dividends, or for companies where the concept of "Free Cash Flow" doesn't apply.

Free Cash Flow applies to companies in almost every industry, except for commercial banks and insurance firms.

And the only firms *outside* those industries that tend to issue dividends on a recurring, predictable basis are utility companies and some trusts/partnerships/MLPs (Master Limited Partnerships), which are common in the midstream energy (pipelines) sector.

So if you're working in one of those industries, the DDM might be essential or useful; if not, it's not important.

Variations of Comparable Companies and Precedent Transactions

One variation of Precedent Transactions is the **M&A Premiums Analysis**, where you look at the **premium** each acquirer paid over each seller's share price and use those figures to value your company.

For example, if you're valuing Steel Dynamics, you might gather a set of 20-30 public manufacturing companies that have been acquired over the past 5 years and calculate the premium the buyer paid in each case.

If a seller's share price was $20.00 before the acquisition, and the buyer paid $25.00 per share for the company, that's a **25%** premium.

You collect that data for all the transactions and then apply the **median** (or some other percentile) to your company's current share price.

So if the median figure is 25%, and your company's share price is currently $28.00, then the company is worth $28.00 * (1 + 25%), or $35.00, according to this methodology.

This method sounds simple, but a few points make it more complicated:

- **Selection Criteria:** You often use broader selection criteria than with Precedent Transactions because you can use only acquisitions of **public companies**. So instead of using acquisitions of U.S.-based steel companies worth at least $500 million, you might reduce the threshold to $100 million.

- **Which Premium?** Often, rumors of an M&A deal break before the actual deal is announced. So the 1-day premium (i.e., the Offer Price / Share Price One Day Prior – 1) might be deceptive. As a result, some people use 30-day or 60-day premiums, or even the premium to the *average* share price over the past 30, 60, 90, or 180 days.

- **It Only Works for Public Companies:** This methodology is pointless for anything *other* than the valuation of a public company. It doesn't apply to private companies or even to less-than-100% acquisitions.

Here's an example analysis for an older valuation of Yahoo:

Yahoo! Inc. - Internet M&A Premiums				Share Price History		Premiums	
Acquirer Name	Target Name	Equity Value	Offer Price	1-Day	20-Day	1-Day	20-Day
Microsoft	aQuantive	$ 6,356	$ 66.50	$ 35.87	$ 31.90	85.4%	108.5%
Publicis	Digitas	1,285	13.50	10.93	10.96	23.5%	23.2%
NBC Universal	iVillage	660	8.50	8.12	7.35	4.7%	15.6%
WPP Group	24/7 Real Media	669	11.75	8.47	8.13	38.7%	44.5%
Investor Group	Vertrue	641	48.50	40.12	38.88	20.9%	24.7%
Omniture	Visual Sciences	384	18.04	17.37	14.50	3.9%	24.4%
Amazon.com	Audible	247	11.50	9.33	8.93	23.3%	28.8%
Nokia	Loudeye	127	4.50	1.79	2.20	151.4%	104.5%
	Maximum	$ 6,356	$ 66.50	$ 40.12	$ 38.88	151.4%	108.5%
	75th Percentile	823	25.66	22.00	18.85	50.4%	59.5%
	Median	**$ 650**	**$ 12.63**	**$ 10.13**	**$ 9.95**	**23.4%**	**26.8%**
	25th Percentile	350	10.75	8.38	7.94	16.8%	24.1%
	Minimum	127	4.50	1.79	2.20	3.9%	15.6%

Based on these figures, we might conclude that Yahoo should receive a 20-30% premium to its current share price if it wants to sell itself.

A variation of Public Comps is the **Future Share Price Analysis**.

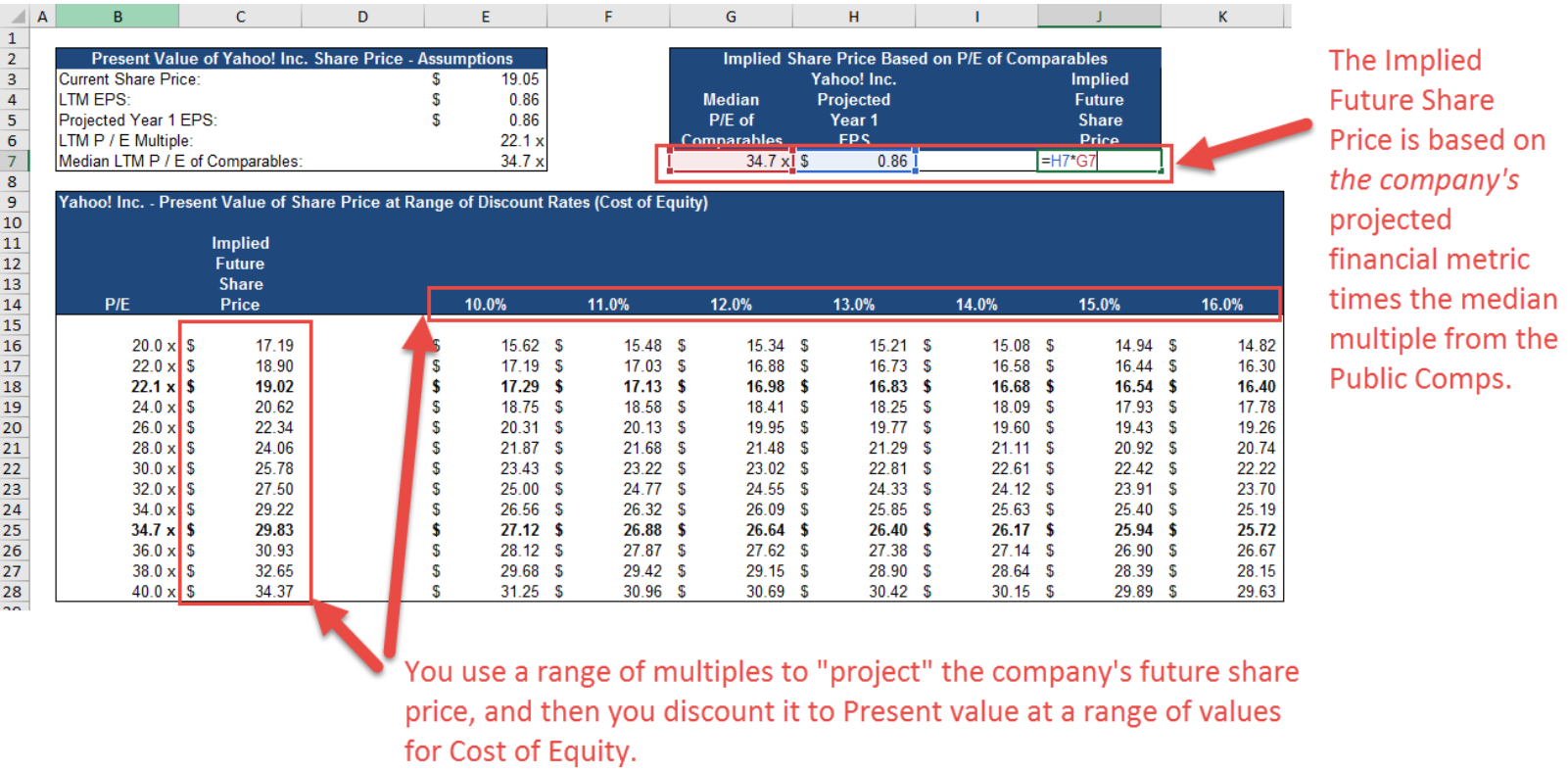
In this one, you take the median *historical* multiple from the Public Comps, usually the P / E multiple, and multiply it by the *future* metric of the company you're valuing.

So you "project" the company's share price by assuming that in 1 or 2 years from now, the company will be trading *at* the median multiple the comps are currently trading at.

Since money today is worth more than money tomorrow, you then **discount** this future share price back to its Present Value by using a range of Discount Rates linked to the company's Cost of Equity.

If you're using Enterprise Value-based multiples instead, you have to back into the Implied Equity Value and Implied Share Price in the future year. You still discount the share price to its Present Value by using Cost of Equity for the Discount Rate.

Here's an example of this analysis for Yahoo:



Present Value of Yahoo! Inc. Share Price - Assumptions		
Current Share Price:	$	19.05
LTM EPS:	$	0.86
Projected Year 1 EPS:	$	0.86
LTM P / E Multiple:		22.1 x
Median LTM P / E of Comparables:		34.7 x

Implied Share Price Based on P/E of Comparables		
Median P/E of Comparables	Yahoo! Inc. Projected Year 1 EPS	Implied Future Share Price
34.7 x	$ 0.86	=H7*G7

Yahoo! Inc. - Present Value of Share Price at Range of Discount Rates (Cost of Equity)

P/E	Implied Future Share Price	10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%
20.0 x	$ 17.19	$ 15.62	$ 15.48	$ 15.34	$ 15.21	$ 15.08	$ 14.94	$ 14.82
22.0 x	$ 18.90	$ 17.19	$ 17.03	$ 16.88	$ 16.73	$ 16.58	$ 16.44	$ 16.30
22.1 x	**$ 19.02**	**$ 17.29**	**$ 17.13**	**$ 16.98**	**$ 16.83**	**$ 16.68**	**$ 16.54**	**$ 16.40**
24.0 x	$ 20.62	$ 18.75	$ 18.58	$ 18.41	$ 18.25	$ 18.09	$ 17.93	$ 17.78
26.0 x	$ 22.34	$ 20.31	$ 20.13	$ 19.95	$ 19.77	$ 19.60	$ 19.43	$ 19.26
28.0 x	$ 24.06	$ 21.87	$ 21.68	$ 21.48	$ 21.29	$ 21.11	$ 20.92	$ 20.74
30.0 x	$ 25.78	$ 23.43	$ 23.22	$ 23.02	$ 22.81	$ 22.61	$ 22.42	$ 22.22
32.0 x	$ 27.50	$ 25.00	$ 24.77	$ 24.55	$ 24.33	$ 24.12	$ 23.91	$ 23.70
34.0 x	$ 29.22	$ 26.56	$ 26.32	$ 26.09	$ 25.85	$ 25.63	$ 25.40	$ 25.19
34.7 x	**$ 29.83**	**$ 27.12**	**$ 26.88**	**$ 26.64**	**$ 26.40**	**$ 26.17**	**$ 25.94**	**$ 25.72**
36.0 x	$ 30.93	$ 28.12	$ 27.87	$ 27.62	$ 27.38	$ 27.14	$ 26.90	$ 26.67
38.0 x	$ 32.65	$ 29.68	$ 29.42	$ 29.15	$ 28.90	$ 28.64	$ 28.39	$ 28.15
40.0 x	$ 34.37	$ 31.25	$ 30.96	$ 30.69	$ 30.42	$ 30.15	$ 29.89	$ 29.63

The Implied Future Share Price is based on *the company's* projected financial metric times the median multiple from the Public Comps.

You use a range of multiples to "project" the company's future share price, and then you discount it to Present value at a range of values for Cost of Equity.

As you've probably guessed, we are not fans of this analysis. There are dozens of problems with it, but let's start with 3 big ones:

1) **Why Would You Apply Historical Multiples to *Projected* Metrics?** This idea is questionable because multiples change over time. There's no guarantee that the LTM multiple that the Public Comps trade at *today* will be the same in 1-2 years.

2) **What Value Does This Add Over a Normal Public Comps Analysis?** This method is another way to use valuation multiples to value a company, but does it *really* add much over using forward multiples and applying them to the company's forward metrics?

3) **You Shouldn't Try to "Project" Share Prices.** Finally, a company's current share price reflects **past performance** and **future expectations**. So how could you possibly "project"

what it will be in the future? You'd have to jump into the future and see what future expectations are at *that point* – and then time travel back to the present.

Sum-of-the-Parts (SOTP) Valuation

This methodology makes some amount of sense, unlike others listed above.

With **Sum of the Parts**, you value each division of a company separately, add up the Implied Enterprise Value for each division, and then back into the Implied Equity Value and Implied Share Price for the entire company at the end.

Sum of the Parts works best for companies with *very* different division: Firms like General Electric or Samsung that operate in everything from aviation to healthcare to transportation.

It makes sense for these companies because each division has a different Discount Rate and expected cash flow growth rate, as well as different comparable companies.

Here's an example analysis for Yahoo:

Yahoo! Inc. - Sum of the Parts Valuation Based on Estimated Revenue Multiples					
	Projected Year 1 Revenue:	Low Multiple	High Multiple	Low EV	High EV
Revenue by Segment:					
Search Advertising:	$ 1,384	6.0 x	7.0 x	$ 8,302	$ 9,685
Display Advertising:	2,415	4.0 x	5.0 x	9,660	12,075
Affiliate Site Revenue:	656	2.0 x	3.0 x	1,313	1,969
Premium Fees:	934	2.0 x	3.0 x	1,868	2,802
Other Revenue:	412	1.0 x	2.0 x	412	823
Total:	**$ 5,801**	**15.0 x**	**20.0 x**	**$ 21,554**	**$ 27,355**
		Implied Share Price:		**$ 21.33**	**$ 25.53**

Yahoo's divisions at this time were a bit different, but not *that* different, so it's a stretch to use this methodology for a company like Yahoo.

And Sum of the Parts **makes no sense** for a company like Steel Dynamics – yes, it has different business divisions, but they're all related to **steel manufacturing**.

Other companies in the sector all have the same types of divisions as well, so you wouldn't even be able to find pure-play Public Comps for each division.

The main downsides to Sum of the Parts are:

1) **It Takes A LOT More Time and Effort to Use** – If the company has 10 divisions, you need to find 10 different sets of comparable companies and precedent transactions, build 10 different DCF analyses, and so on.

2) **You May Not Have Enough Information to Use It** – For example, many companies disclose *revenue* by segment, but not operating income, taxes, Working Capital, or CapEx by segment. You'll have a tough time building a separate DCF for each division without this information.

   All companies also have **corporate overhead expenses** that are not allocated to one specific division. You need to factor those into the analysis when you calculate the Implied Value for the entire company, but not all companies disclose these figures.

Leveraged Buyout (LBO) Valuation

This one is a whole separate topic (see the LBO lessons/sections/guides), but you can also value a company by **assuming that a private equity firm buys it, runs it for several years, and sells it in the future, and targets a specific IRR with the investment**.

For example, let's say that a private equity firm plans to acquire a company, hold it, and sell it in 5 years.

They anticipate being able to sell it for an EV / EBITDA multiple between 12x and 15x, and they want to use 50% debt and 50% equity to purchase it. The firm is targeting a 20% IRR.

You could set up the LBO model to calculate IRR, and then use the Goal Seek function in Excel to determine the **maximum purchase price** that will yield that 20% IRR.

That price would differ based on the exit multiple, so you would show the maximum purchase price that yields the 20% IRR at exit multiples ranging from 12x to 15x.

You use this methodology as more of a "sanity check" or "initial screen" – for example, a private equity firm considering a deal might run this analysis to decide if a deal makes sense before spending time/money on it.

If the maximum amount the PE firm can pay to realize a 20% IRR is $1 billion, but the company's Current Enterprise Value is $1.5 billion, it's an easy "pass."

But if the company's Current Enterprise Value is only $800 million, then the deal might work.

Industry-Specific Valuation

This topic is beyond the scope of this guide, so take a look at the summary in the Equity Vale and Enterprise Value Guide or our industry-specific guides and courses.

In short, there are also industry-specific valuation methodologies in industries such as commercial banking, insurance, real estate investment trusts (REITs), and oil & gas.

But even these "new" methodologies aren't truly "new": They're primarily variations of the DCF Analysis.

For example, the **Net Asset Value (NAV) Model** for oil & gas is a DCF with no Terminal Value.

You assume that the company stops exploring for more oil and gas and that it produces everything it has until its reserves are depleted.

As a result, its Cash Flow eventually goes to $0 in the future.

You discount and sum up all the cash flows as you do in any DCF, but you skip Terminal Value because it makes no sense here.

For life insurance, the **embedded value** methodology is a similar far-in-the-future DCF analysis where a company's Implied Value is linked to its Balance Sheet (Assets minus Liabilities) plus the Present Value of Future Cash Profits from its policies.

Since life insurance policies can last for 20 or 30 years, you might create projections for decades into the future with this one.

For most other industries, the standard multiples, metrics, and methodologies earlier in this guide apply.

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Key Rule #10: How to Put Together and Use a Full Valuation

When you've finished your DCF analysis, Public Comps, and Precedent Transactions, you **see how all the methodologies stack up**.

You do this by showing the range of multiples from each methodology on the same page.

Here's our summary page for Steel Dynamics:

Valuation Summary - Steel Dynamics Inc.	Steel Dynamics Inc. - Range of Valuation Multiples / Premiums					
Methodology Name	Maximum Multiple	75th Percentile Multiple	Median Multiple	25th Percentile Multiple	Minimum Multiple	Applicable Company Figure
Public Company Comparables:						
LTM EV / Revenue:	1.2 x	1.1 x	0.7 x	0.5 x	0.5 x	$ 7,307.2
FY 16 EV / Revenue:	1.2 x	1.0 x	0.7 x	0.5 x	0.5 x	7,716.0
FY 17 EV / Revenue:	1.1 x	1.0 x	0.7 x	0.5 x	0.5 x	8,406.2
LTM EV / EBITDA:	14.0 x	9.4 x	9.1 x	6.3 x	5.5 x	862.8
FY 16 EV / EBITDA:	11.9 x	8.5 x	8.0 x	7.5 x	6.5 x	626.4
FY 17 EV / EBITDA:	10.4 x	7.7 x	6.5 x	5.9 x	5.6 x	730.2
LTM P / E:	33.2 x	22.6 x	17.9 x	16.0 x	13.7 x	12.1
FY 16 P / E:	19.1 x	18.1 x	15.4 x	13.9 x	13.5 x	170.7
FY 17 P / E:	15.6 x	12.3 x	11.1 x	9.6 x	8.0 x	205.8
Precedent Transactions:						
LTM EV / Revenue:	3.6 x	1.2 x	0.8 x	0.7 x	0.4 x	7,307.2
LTM EV / EBITDA:	29.4 x	19.2 x	12.5 x	8.4 x	8.0 x	862.8
Discounted Cash Flow Analysis:						
9.50% - 10.50% WACC, 2.30% - 2.70% Terminal FCF Growth Rate:						

Then, you calculate the **Implied Enterprise Value** or **Implied Equity Value** based on each multiple in this set and the company's applicable figure.

For example, if the minimum LTM EV / Revenue multiple is 2.0x, and the company's LTM revenue is $1,000, then its Implied Enterprise Value is $2,000 based on that multiple.

For private companies, you often stop there.

But if you're valuing a public company, you then back into the Implied Equity Value by adding non-core-business Assets and subtracting Liability and Equity items that represent other investor groups.

And then you divide by the company's share count to get its Implied Share Price.

You repeat this process for all the multiples so that you get **ranges of Implied Share Price:**

Valuation Summary - Steel Dynamics Inc.	Steel Dynamics Inc. - Range of Valuation Multiples / Premiums						Steel Dynamics Inc. - Implied Per Share Value Range				
Methodology Name	Maximum Multiple	75th Percentile Multiple	Median Multiple	25th Percentile Multiple	Minimum Multiple	Applicable Company Figure	Minimum Multiple	25th Percentile Multiple	Median Multiple	75th Percentile Multiple	Maximum Multiple
Public Company Comparables:											
LTM EV / Revenue:	1.2 x	1.1 x	0.7 x	0.5 x	0.5 x	$ 7,307.2	$ 8.86	$ 10.07	$ 15.03	$ 26.39	$ 29.94
FY 16 EV / Revenue:	1.2 x	1.0 x	0.7 x	0.5 x	0.5 x	7,716.0	10.13	10.91	16.28	26.33	31.01
FY 17 EV / Revenue:	1.1 x	1.0 x	0.7 x	0.5 x	0.5 x	8,406.2	10.83	11.80	17.45	28.49	33.24
LTM EV / EBITDA:	14.0 x	9.4 x	9.1 x	6.3 x	5.5 x	862.8	13.56	16.37	26.47	27.33	43.89
FY 16 EV / EBITDA:	11.9 x	8.5 x	8.0 x	7.5 x	6.5 x	626.4	10.69	13.27	14.58	15.95	24.85
FY 17 EV / EBITDA:	10.4 x	7.7 x	6.5 x	5.9 x	5.6 x	730.2	10.90	11.83	13.59	17.20	25.25
LTM P / E:	33.2 x	22.6 x	17.9 x	16.0 x	13.7 x	12.1	0.69	0.80	0.90	1.13	1.66
FY 16 P / E:	19.1 x	18.1 x	15.4 x	13.9 x	13.5 x	170.7	9.51	9.84	10.87	12.76	13.46
FY 17 P / E:	15.6 x	12.3 x	11.1 x	9.6 x	8.0 x	205.8	6.84	8.18	9.47	10.44	13.26
Precedent Transactions:											
LTM EV / Revenue:	3.6 x	1.2 x	0.8 x	0.7 x	0.4 x	7,307.2	4.55	13.68	18.46	29.74	101.41
LTM EV / EBITDA:	29.4 x	19.2 x	12.5 x	8.4 x	8.0 x	862.8	22.38	24.05	38.71	62.31	98.95
Discounted Cash Flow Analysis:											
9.50% - 10.50% WACC, 2.30% - 2.70% Terminal FCF Growth Rate:							16.03	17.00	18.06	19.21	20.49

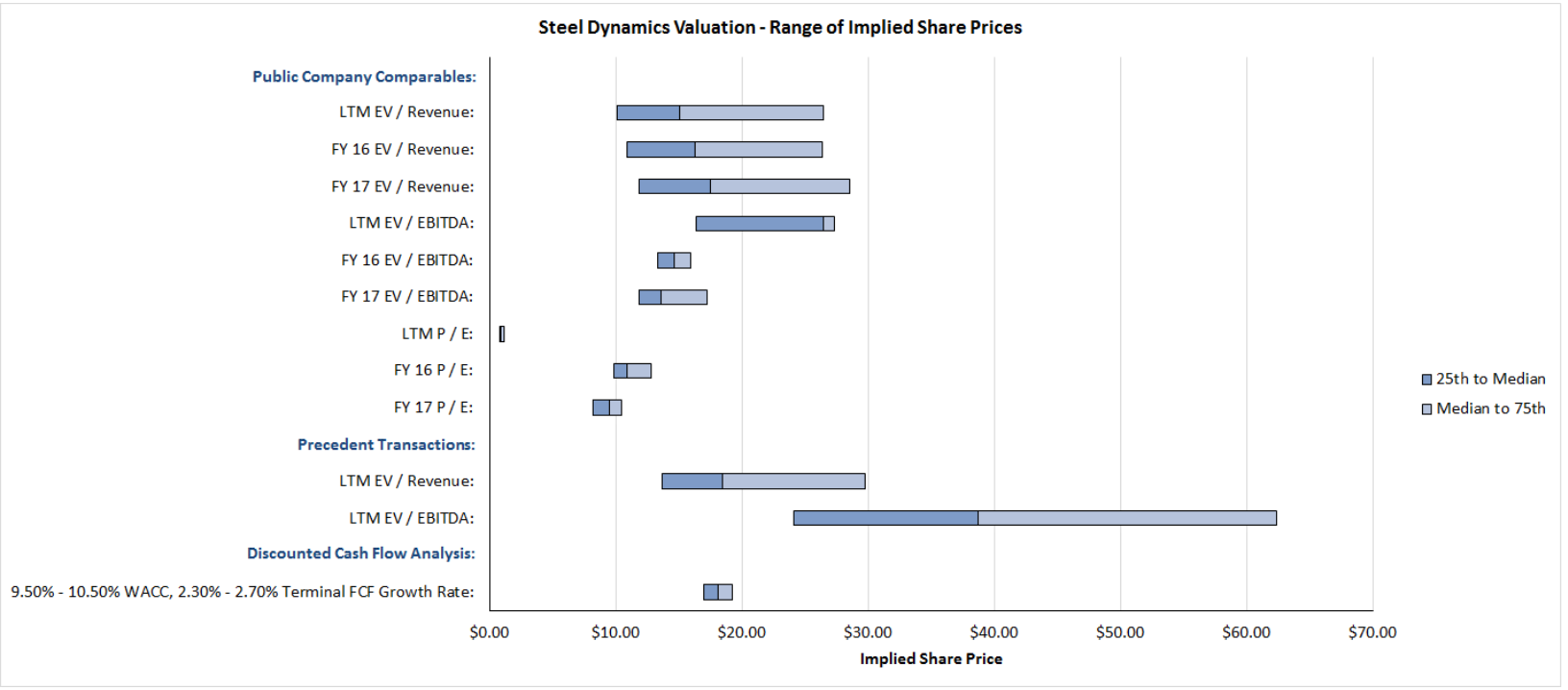
You use the range of multiples on the left, apply each one to the relevant financial stats for Steel Dynamics, and calculate the Implied Share Prices for different multiples and time frames.

For the DCF, you just take the range of Implied Share Prices from the sensitivity tables.

You don't have to use this process for the DCF output because the DCF should be set up to calculate the Implied Share Price already. So you simply link to a range of values around the center of the sensitivity table:

		Weighted Average Cost of Capital (WACC):										
		8.75%	9.00%	9.25%	9.50%	9.75%	**10.00%**	10.25%	10.50%	10.75%	11.00%	11.25%
Terminal FCF	2.80%	$ 24.52	$ 23.16	$ 21.91	$ 20.75	$ 19.67	**$ 18.67**	$ 17.74	$ 16.88	$ 16.06	$ 15.30	$ 14.59
Growth Rate	2.70%	24.18	22.85	21.63	20.49	19.44	**18.46**	17.55	16.70	15.90	15.15	14.45
(Terminal	2.60%	23.85	22.55	21.35	20.25	19.21	**18.26**	17.36	16.52	15.74	15.00	14.31
Value	**2.50%**	23.53	22.26	21.09	20.00	19.00	**18.06**	17.18	16.35	15.58	14.86	14.18
Calculated	2.40%	**23.22**	**21.98**	**20.83**	**19.77**	**18.78**	**17.86**	**17.00**	**16.19**	**15.43**	**14.72**	**14.05**
Using the	2.30%	22.92	21.71	20.59	19.54	18.57	**17.67**	16.82	16.03	15.28	14.58	13.92
Gordon	2.20%	22.62	21.44	20.34	19.32	18.37	**17.48**	16.65	15.87	15.14	14.45	13.80
Growth	2.10%	22.34	21.18	20.11	19.11	18.18	**17.30**	16.49	15.72	15.00	14.32	13.68
Method):	2.00%	22.06	20.93	19.88	18.90	17.98	**17.13**	16.32	15.57	14.86	14.19	13.56

Once you have this, you then create a "Football Field" chart that shows the ranges of Implied Share Prices using bar charts:



Our conclusions here might be:

1) **Implied Value** – Steel Dynamics is likely worth between $15.00 and $20.00 per share because the DCF output is in that range, as are most of the median Implied Share Prices from the Public Comps.

   The company's share price was $24.97 at the time of this analysis, making it modestly overvalued.

2) **Useless Methodologies and Multiples** – The P / E multiples seem so far off from everything else that we shouldn't pay much attention to them. The Precedent Transactions also produce values that are far off from everything else, though the Implied Value from the median EV / Revenue multiple seems plausible.

Your next steps depend on **where you're working** and the purpose of this analysis.

For example, if you're working at an investment bank and you advise companies on deals, you might tell the Steel Dynamics management team the following based on this analysis:

- **Company Value** – If the team wants to know what the company is "really worth," you'd likely tell them, "Between $15.00 and $20.00 per share."

- **It's Potentially a Good Time to Sell** – The company trades at a premium to its intrinsic value, and an acquirer will have to pay even more to acquire the company. So **IF** – a big "If" – you can find willing acquirers, the outcome might be positive.

- **It Might Also Be a Good Time to Raise Equity** – Companies benefit from raising Equity when they trade at higher multiples and at premiums to their intrinsic values; Equity produces less dilution in those cases because the company raises the same amount of capital but issues fewer shares to do so.

On the other hand, if you're working in a **buy-side role**, such as at a hedge fund or private equity firm, your interpretation would be different.

In those roles, the key question is whether or not you should **invest** in a company.

Buying a company, or buying a small stake in a company, makes the most sense when it appears to be **undervalued** and when specific events ("catalysts") might cause the share price to change in the next 6-12 months.

So a private equity firm might conclude that since Steel Dynamics trades at a premium to its intrinsic value, it is **not** a great investment right now.

The firm might still build a leveraged buyout model and see if it can achieve its targeted IRRs despite this problem, but the valuation alone would make a deal less likely.

A hedge fund might conclude that the company is **overvalued** and that its share price could decline in the next 6-12 months.

That makes it, potentially, a good **"Short"** candidate – a company that you bet *against* and then profit from when its share price declines.

But the company isn't overvalued by *that much*. A 20-30% difference is decent, but many funds want a much bigger discrepancy to have a higher **margin of safety**.

Since valuation is so dependent on assumptions, and since many of these assumptions could be wrong, it's risky to short a company's stock unless it seems *extremely* overvalued (e.g., its current share price is $100, but you believe it's worth only $10).

Some funds might still think about shorting the company in this case if they can reasonably **hedge** themselves with options or other investments, but others might stay away because the pricing discrepancy isn't big enough.

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Key Rule #11: Trade-Offs of Different Methodologies

We've covered a lot in these lessons and this guide, so this last section provides a **summary** of the trade-offs of different methodologies:

Advantages and Disadvantages of the Main Valuation Methodologies:

Methodology Name:	Public Comps	Precedent Transactions	Discounted Cash Flow Analysis
Advantages:	• Based on **real market data**. • **Less** dependent on future assumptions. • **Quick** to calculate and easy to understand/explain.	• Based on what real companies have **actually** paid for other companies. • May show **industry trends** more effectively than Public Comps.	• **Not** as subject to market fluctuations/conditions. • Most "correct" methodology according to **finance theory**. • Better reflects **company-specific** factors and scenarios/stages.
Disadvantages:	• There may not be **true** comparables. • Less accurate for thinly traded stocks or **volatile** companies. • May **undervalue** companies' long-term potential. • The market might be **wrong**!	• **Data** can be limited and misleading. • There may not be **truly comparable** transactions. • Multiples don't capture **all the aspects** of a deal. • Specific **market conditions** can greatly impact output.	• Very dependent on **far-in-the-future** assumptions. • Bankers are notoriously **bad** at making reasonable assumptions. • Widespread **disagreement** on how to estimate figures like Cost of Equity and WACC.

And then for the more "exotic" methodologies:

- **Liquidation Valuation** – It's difficult to determine the market values of everything on the Balance Sheet, and it undervalues healthy, growing companies; it's more appropriate for distressed companies.

- **Dividend Discount Model** – Useful for companies that issue predictable dividends or for cases in which Free Cash Flow is meaningless, but it's not useful for non-dividend-paying companies.

- **M&A Premiums Analysis** – It's helpful for assessing what an acquirer might have to pay for a public company, but it's not useful for valuing private companies or non-100% acquisitions.

- **Future Share Price Analysis** – There are no real positives. The methodology itself – applying historical multiples to projected metrics – is questionable, and it doesn't add much over normal Public Comps. Even if you choose to apply *future* multiples to *future* metrics, it doesn't add much over Public Comps.

- **Sum of the Parts** – It's useful for valuing conglomerates and companies with very different divisions, but it takes a lot more time and effort to use, and the company may not disclose all the information you need.

- **Leveraged Buyout Valuation** – It's helpful for PE firms thinking about the maximum amount they could pay for a firm to achieve a certain IRR, but it's used more as an initial screen or sanity check than a strict valuation methodology.

Comparing Expected Values from Different Methodologies

Since all the methodologies depend on your assumptions, it's difficult to make **universal statements** about which one, if any, produces the "highest" values.

Here's what we *can* say:

- **Precedent Transactions vs. Public Comps:** Transactions *tend* to produce higher Implied Values due to the **control premium**. But this rule doesn't always hold up, especially if market conditions have suddenly changed.

- **M&A Premiums Analysis vs. Public Comps:** Like the Precedent Transactions, the M&A Premiums Analysis tends to produce higher Implied Values because of the **control premium**.

- **Discounted Cash Flow:** This one often produces the most *variable* output since it's more dependent on your assumptions than any other methodology. But if you use reasonable assumptions, you shouldn't get nonsensical results – see the Steel Dynamics example.

- **Liquidation Valuation:** This one will produce the **lowest** Implied Values for healthy companies because they're worth significantly more than what their Balance Sheets suggest.

- **Sum of the Parts:** If a company truly *is* worth more in "parts," then this one will produce higher Implied Values than if you valued the entire company as a whole using *one* DCF, *one* set of comparable companies, and so on.

- **LBO Valuation:** This one tends to produce values on the lower end of the range because it gives you the *maximum* price a PE firm could pay to achieve a certain IRR. So unlike the other methodologies, it sets a "ceiling" on valuation.

There are so many exceptions to these rules that we suggest **avoiding** this topic in interviews.

It's best to turn the conversation back to the trade-offs of the different methodologies and explain the *reasons* why the output differs rather than claiming that one specific approach will produce the highest or lowest values.

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Interview Questions

Interview questions on valuation are extremely common, but we've already covered many of them in the guide on **Equity Value**, **Enterprise Value**, and **Valuation Multiples**.

As a result, we're going to focus more on the **DCF analysis** here, as well as how to use methodologies like **Public Comps** and **Precedent Transactions** in real life.

Interviews have evolved to the point where simple questions with easily-memorized answers (e.g., "What are the 3 valuation methodologies?") are not common.

Instead, interviewers are more likely to test your **conceptual understanding** by asking you to walk through analyses, explain the trade-offs, and apply the methodologies to advise clients and make investment recommendations.

The Purpose of Valuation

These questions are quite high-level, but many candidates don't understand *the point* of valuation.

You can't answer the more detailed questions without knowing that, so don't dismiss these questions as "too basic" – even if you have significant work experience.

1. What's the point of valuation? WHY do you value a company?

You value a company to determine its **Implied Value** according to your views of it.

If this Implied Value is very different from the company's Current Value, you might be able to invest in the company and make money if its value changes.

If you are advising a client company, you might value it so you can tell the management team the price that it might receive if the company wants to sell, which is usually different from its Current Value.

2. But public companies already have Market Caps and share prices. Why bother valuing them?

Because a company's Market Cap and Share Price reflect its **Current Value** according to "the market" – but the market might be wrong!

You value companies to see if the market's views are correct or incorrect.

3. What are the advantages and disadvantages of the 3 main valuation methodologies?

Public Comps are useful because they're based on real market data, are quick to calculate and explain, and are less subject to far-in-the-future assumptions.

However, there may not be true comparable companies, the analysis will be less accurate for volatile or thinly traded companies, and it may undervalue companies' long-term potential.

Precedent Transactions are useful because they're based on the **real prices** that companies have paid for other companies, and they may reflect industry trends more than Public Comps.

However, the data is often spotty and misleading, there may not be comparable transactions, and specific deal terms and market conditions might distort the multiples.

DCF Analysis is the most "correct" methodology according to finance theory, it's less subject to market fluctuations, and it better reflects company-specific factors and long-term trends.

However, it's also very dependent on far-in-the-future assumptions, and there's disagreement over the proper calculation methods for key figures like Cost of Equity and WACC.

4. Which of the 3 main methodologies will produce the highest Implied Values?

This is a trick question because almost any methodology could produce the highest Implied Values depending on the industry, time period, and assumptions.

Precedent Transactions *generally* produce higher Implied Values than Public Comps because of the **control premium** – the extra amount that acquirers must pay to acquire sellers.

But it's tough to say how a DCF stacks up because it's far more dependent on your assumptions.

So the best answer is: "A DCF tends to produce the most variable output, depending on your assumptions, and Precedent Transactions tend to produce higher values than Public Comps because of the control premium."

5. When is a DCF more useful than Public Comps or Precedent Transactions?

You should pretty much always build a DCF since it **IS** valuation – the other methodologies are supplemental.

But it's especially useful when the company you're valuing is mature and has stable, predictable cash flows, or when you lack good Public Comps and Precedent Transactions.

6. When are Public Comps or Precedent Transactions more useful than the DCF?

If the company you're valuing is early-stage, and it is impossible to estimate its future cash flows or the company has no path to cash flow at all, you have to rely on these other methodologies.

These other methodologies can also be more useful when you run into problems in the DCF, such as the inability to estimate the Discount Rate, or when cash flows fluctuate wildly.

7. Which should be worth more: A $500 million EBITDA healthcare company or a $500 million EBITDA industrials company?

Assume the growth rates, margins, and all other financial stats are the same.

In all likelihood, the healthcare company will be worth more because healthcare is a **less asset-intensive industry**. That means the company's CapEx and Working Capital requirements will be lower, and Free Cash Flow will be higher as a result.

Healthcare, at least in some sectors, also tends to be more of a "growth industry" than industrials.

The Discount Rate might also be higher for the healthcare company, but the lower asset intensity and higher expected growth rates would, more likely than not, make up for that.

However, this answer is an *extreme* generalization, so you need more information to make a real decision.

8. How do you value an apple tree?

The same way you value a company: Comparables and a DCF. You'd look at what similar apple trees have sold for, and then calculate the expected future cash flows from the apples the tree produces.

You would then discount those cash flows, discount the Terminal Value, and add up everything to determine its Implied Value.

The Discount Rate would be based on your **opportunity cost** – what you might be able to earn each year by investing in other, similar apple trees.

9. People say the DCF is an intrinsic valuation methodology, whereas Public Comps and Precedent Transactions are relative.

But is that correct?

No, not exactly. The DCF **is** based on the company's expected future cash flows, more so than the others, so in that sense, it is "intrinsic valuation."

But the **Discount Rate** used in a DCF is linked to peer companies (market data), and if you use the Multiples Method to calculate Terminal Value, that multiple is also linked to peer companies.

The DCF is less subject to market influence than the other methodologies, but there is still *some* influence.

It's better to say that the DCF is *more of* an intrinsic valuation methodology than the others.

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DCF Analysis – Walking Through and Explaining It

Questions on the DCF setup are the most common ones in interviews. Even if you don't understand the more advanced items that go into the analysis, you **must** be able to walk through it.

It's also important to understand the relationship between a DCF and other methodologies, particularly why valuation multiples are **shorthand** for valuation.

1. Why do you build a DCF analysis to value a company?

You build a DCF analysis because a company is worth the Present Value of its expected future cash flows:

Company Value = Cash Flow / (Discount Rate – Cash Flow Growth Rate)

However, it's not as simple as using that formula because a company's **Cash Flow Growth Rate** and **Discount Rate** change over time.

So in a Discounted Cash Flow analysis, you divide the company into two periods: One where those assumptions change (the **explicit forecast period**) and one where they stay the same (the **Terminal Period**).

You then forecast the company's cash flows in both periods and discount them to their Present Value based on the appropriate Discount Rate(s).

Then, you compare this sum – the company's Implied Value – to the company's Current Value or "Asking Price" to see if it's valued appropriately.

2. Walk me through a DCF analysis.

A DCF values a company based on the Present Value of its Cash Flows in the explicit forecast period plus the Present Value of its Terminal Value.

You start by projecting the company's Free Cash Flows over the next 5-10 years by making assumptions for revenue growth, margins, Working Capital, and CapEx.

Then, you discount the cash flows using the Discount Rate, usually the Weighted Average Cost of Capital, and sum up everything.

Next, you estimate the company's Terminal Value using the Multiples Method or the Gordon Growth Method; it represents the company's value *after* those first 5-10 years into perpetuity.

You then discount the Terminal Value using the Discount Rate and add it to the sum of the company's discounted cash flows.

Finally, you compare this to the company's Current Value, usually its Enterprise Value, though you'll often calculate the company's Implied Share Price so you can compare it to the Current Share Price.

3. How do you move from Revenue to Free Cash Flow in a DCF?

First, **confirm** that they are asking for *Unlevered* Free Cash Flow (Free Cash Flow to Firm). If so:

Subtract COGS and Operating Expenses from Revenue to get to Operating Income (EBIT).

Then, multiply Operating Income by (1 – Tax Rate), add back Depreciation & Amortization, and then factor in the Change in Working Capital.

If the company *spends* extra cash as it grows, the Change in Working Capital will be negative; if it *generates* extra cash flow as a result of its growth, it will be positive.

Finally, subtract Capital Expenditures to calculate Unlevered Free Cash Flow.

Levered Free Cash Flow (FCFE) is similar, but you subtract the Net Interest Expense before multiplying by (1 – Tax Rate), and you subtract Mandatory Debt Repayments at the end.

4. What does the Discount Rate mean?

The Discount Rate represents the **opportunity cost** for the investors – what they could earn by investing in other, similar companies in this industry.

A **higher** Discount Rate means the risk and *potential* returns are both higher; a **lower** Discount Rate implies lower risk and lower *potential* returns.

A **higher** Discount Rate makes a company **less valuable** because it means the investors have better opportunities elsewhere; a **lower** Discount Rate makes a company **more valuable**.

5. How do you calculate Terminal Value in a DCF, and which method is better?

You can use the **Multiples Method** or the **Gordon Growth Method** (AKA Long-Term Growth Method, Perpetuity Growth Method, etc.)

With the first one, you apply a Terminal Multiple to the company's EBITDA, EBIT, NOPAT, or FCF in the final year of the forecast period. For example, if you apply a 10x EV / EBITDA multiple to the company's Year 10 EBITDA of $500, its Terminal Value is $5,000.

With the Gordon Growth Method, you assign a "Terminal Growth Rate" to the company's Free Cash Flows in the Terminal Period and assume they'll grow at that rate forever.

Terminal Value = Final Year Free Cash Flow * (1 + Terminal Growth Rate) / (Discount Rate – Terminal Growth Rate)

Ultimately, the Gordon Growth Method is better because growth *always* slows down over time; all companies' cash flows eventually start growing more slowly than GDP.

If you use the Multiples Method, it's easy to pick a multiple that **makes no logical sense** because it implies a growth rate that's too high.

However, many bankers still use the Multiples Method because they don't realize the implications or because it's "easier."

6. What are some signs that you might be using the incorrect assumptions in a DCF?

The most common signs of trouble are:

1. **Too Much Value from the PV of Terminal Value** – It usually accounts for at least 50% of the company's total Implied Value, but it shouldn't account for, say, 95% of its value.

2. **Implied Terminal Growth Rates or Terminal Multiples That Don't Make Sense** – If you pick a Terminal Multiple that implies a Terminal FCF Growth Rate of 8%, but the country's long-term GDP growth rate is 3%, something is wrong.

3. **You're Double-Counting Items** – If an income or expense line item is *included* in FCF, you should **not** be counting it in the Implied Enterprise Value → Implied Equity Value calculation at the end, and vice versa if it's *excluded* from FCF.

4. **Mismatched Final Year FCF Growth and Terminal Growth Rate** – If the company's Free Cash Flow is growing at 15% in the final year, but you've assumed a 2% Terminal Growth Rate, something is wrong. FCF growth should decline over time and approach the Terminal Growth Rate by the end of the explicit forecast period.

7. If your DCF *seems* off, what are the easiest ways to fix it?

The simplest method is to **extend the explicit forecast period** so that the company's Free Cash Flow contributes more value, and so that there's more time for FCF growth to slow down and approach the Terminal Growth Rate.

So if you're using a 5-year forecast period, extend it to 10 or 15 years and reduce the company's FCF growth in those extra years as it approaches maturity.

To avoid double-counting items… um, look at what you're doing and don't double count!

Finally, you'll often have to reduce the Terminal Value by picking a lower Terminal Growth Rate or lower Terminal Multiple. Terminal Value tends to be overstated in financial models because people don't understand the theory behind it.

8. How do you interpret the results of a DCF?

You compare the company's *Implied* Enterprise Value, Equity Value, or Share Price to its *Current* Enterprise Value, Equity Value, or Share Price to see if it might be overvalued or undervalued.

You do this over a **range of assumptions** because investing is probabilistic.

For example, if you believe that, based on a range of plausible revenue growth and margin assumptions, the company's Implied Share Price is worth between $15.00 and $20.00, but its Current Share Price is $8.00, then that is good evidence that it may be **undervalued**.

But if its Current Share Price is $17.00, then it may be valued appropriately.

9. Does a DCF ever make sense for a company with negative cash flows?

Yes, it may. A DCF is based on a company's **expected future cash flows**, so even if the company is cash flow-negative right now, the analysis could work if it starts generating positive cash flow in the future.

If the company has no plausible path to positive cash flow or you can't reasonably forecast cash flow, then the analysis doesn't make sense.

10. How do Levered DCF Analysis and Adjusted Present Value (APV) Analysis differ from an Unlevered DCF?

In a Levered DCF, you use Levered FCF for the cash flows and Cost of Equity for the Discount Rate, and you calculate Terminal Value using Equity Value-based multiples such as P / E.

You don't have to back into Implied Equity Value at the end because the analysis already produces the Implied Equity Value.

An APV Analysis is similar to a traditional Unlevered DCF, but you value the company's **Interest Tax Shield** separately and add its Present Value at the end.

You still calculate Unlevered FCF and Terminal Value in the same way, but you use *Unlevered* Cost of Equity for the Discount Rate (i.e., Risk-Free Rate + Equity Risk Premium * Unlevered Beta).

You then project the Interest Tax Shield each year, discount it at that same Discount Rate, calculate the Interest Tax Shield Terminal Value, discount it, and add up everything at the end.

11. Will you get the same results from an Unlevered DCF and a Levered DCF?

No. The simplest explanation is that an Unlevered DCF does **not** factor in the interest rate on the company's Debt, whereas the Levered DCF does.

That alone will create a difference, but the more volatile cash flows in a Levered DCF and the difficulty of picking "equivalent" assumptions in both analyses will also create differences.

12. Why do you typically use the Unlevered DCF rather than the Levered DCF or APV Analysis?

The traditional Unlevered DCF is easier to set up, forecast, and explain, and it produces more consistent results than the other methods.

With the other methods, you have to project the company's Cash and Debt, Net Interest Expense, and mandatory Debt repayments, all of which require more time and effort.

The Levered DCF sometimes produces odd results because Debt principal repayments can spike the Levered FCF up or down suddenly.

The APV Analysis is flawed because it doesn't factor in the **main downside of Debt:** Increased chances of bankruptcy. You can try to include this risk, but no one agrees on how to estimate it numerically.

The Unlevered DCF solves this issue because WACC decreases with more Debt, at first, but then starts *increasing* past a certain level, which reflects that added risk of bankruptcy.

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DCF Analysis – Calculating Free Cash Flow

Calculating Unlevered FCF is simple if you remember the key rules: include only *recurring* items that are related to the company's *core business* and that are available to *all* investor groups.

There are some trickier topics related to this calculation, but you can answer 90% of questions by understanding that rule.

1. WHY do you calculate Unlevered Free Cash Flow by excluding and including various items on the financial statements?

Unlevered FCF must capture the company's **core, recurring items that are available to ALL investor groups**.

That's because Unlevered FCF corresponds to Enterprise Value, which also represents the value of the company's core business that's available to all investor groups.

So if an item is **NOT** recurring, **NOT** related to the company's core business, or **NOT** available to all investor groups, you leave it out.

This rule explains why you exclude all of the following items:

- **Net Interest Expense** – Only available to Debt investors.
- **Other Income / (Expense)** – Corresponds to non-core-business Assets.
- **Most non-cash adjustments besides D&A** – They're non-recurring.
- **The Cash Flow from Financing section** – They're available only to certain investors.
- **Most of Cash Flow from Investing** – Only CapEx is a recurring, core-business item.

2. How does the Change in Working Capital affect Free Cash Flow, and what does it tell you about a company's business model?

The Change in Working Capital tells you whether the company *generates* more cash than expected as it grows, or whether it *requires* more cash to fuel that growth.

It's related to whether a company records items *before* or *after* paying or collecting them in cash.

For example, retailers tend to have negative values for the Change in Working Capital because they must pay for Inventory upfront before they can sell products.

But subscription-based software companies often have positive values for the Change in Working Capital because they collect cash from long-term subscriptions upfront and recognize the revenue over time.

The Change in WC could reduce or increase the company's Free Cash Flow, but it's rarely a major value driver because it tends to be fairly small for most companies.

3. Should you add back Stock-Based Compensation to calculate Free Cash Flow? It's a non-cash add-back on the Cash Flow Statement.

No! SBC is not a real non-cash expense in the context of valuation because it creates **additional shares** and dilutes the existing investors.

By contrast, Depreciation & Amortization relate to **timing differences**: The company paid for something earlier on, but recognizes it over several years.

It's true that Stock-Based Compensation **is** a non-cash expense on the Cash Flow Statement, but the **context** is different: Accounting rather than valuation.

The financial statements reflect the true impact of SBC because the company's **diluted share count** goes up as a result.

In a DCF, you should either count SBC as a real cash expense or include it as a non-cash add-back and reflect the additional shares, which will reduce the company's Implied Share Price.

Most DCF analyses get this completely wrong because they don't use either approach: They pretend that SBC is a normal non-cash charge that makes no impact on the share count.

4. What's the proper tax rate to use when calculating FCF – the effective tax rate, the statutory tax rate, or the cash tax rate?

The company's Free Cash Flows should reflect the **cash taxes** it pays.

So it doesn't matter which rate you use as long as the cash taxes are correct.

For example, you could use the company's effective tax rate (Income Statement Taxes / Pre-Tax Income), and then factor in Deferred Taxes within the non-cash adjustments.

So if a company pays more or less in taxes than what it has recorded on its Income Statement, you could adjust afterward.

Or you could calculate the company's "cash tax rate" and skip the Deferred Tax adjustments.

You could even use the statutory tax rate and make adjustments for state/local taxes and other items to arrive at the company's real cash taxes.

It's most common to use the **effective tax rate** and then adjust for Deferred Taxes based on historical trends.

5. How should CapEx and Depreciation change over the explicit forecast period?

Just like the company's Free Cash Flow growth rate should decline over the explicit forecast period, the company's CapEx and Depreciation should also decline.

High-growth companies tend to spend more on Capital Expenditures to support their growth, but this spending declines over time as the companies move from "growth" to "maintenance."

If the company's FCF is **growing**, CapEx should always exceed Depreciation, but there may be less of a difference by the end.

If the company's FCF is **growing**, **CapEx should never EQUAL Depreciation**.

That's partially due to inflation (capital assets purchased 5-10 years ago cost less back then), and partially because if you're assuming FCF growth in the Terminal Period, Net PP&E needs to keep growing to support it.

If you're assuming that the company's FCF declines or stagnates, then you might use different assumptions.

6. Should you reflect inflation in the FCF projections?

In most cases, no. Clients and investors tend to think in nominal terms, and assumptions for prices and salaries tend to be based on nominal figures.

If you reflect inflation, then you also need to *forecast* inflation far into the future and adjust all figures in your analysis.

This extra effort is probably not worth it because of the uncertainty and extra work.

7. If the company's capital structure is expected to change, how do you reflect it in FCF?

You'll reflect it directly in a Levered DCF because the company's Net Interest Expense and Debt Repayments will change over time.

It won't show up *explicitly* in Unlevered FCF, but you **will** still reflect it in the analysis by changing the Discount Rate over time – WACC changes as the company's Debt and Equity levels change.

And in a Levered FCF, Cost of Equity will change because additional Debt increases the Cost of Equity and less Debt reduces it.

8. What's the relationship between including an income or expense line item in FCF and the Implied Equity Value calculation at the end of the DCF?

If you **include** an income or expense in Free Cash Flow, then you should **exclude** the corresponding Asset or Liability when moving from Implied Enterprise Value to Implied Equity Value at the end (and vice versa for items you **include**).

For example, if you capitalize the company's operating leases and count them as a Debt-like item at the end, then you should **exclude** the rental expense from FCF, making it higher.

This rule also explains why, in an Unlevered DCF analysis, you have to factor in Cash and Debt when moving to the Implied Equity Value: You've **excluded** the corresponding items on the Income Statement (Interest Income and Interest Expense).

9. How do Net Operating Losses (NOLs) factor into Free Cash Flow?

You could set up an NOL schedule and use them to reduce the company's cash taxes, also factoring in accruals if the company ever records negative Pre-Tax Income.

If you do this, then you don't need to count them in the Implied Enterprise Value → Implied Equity Value calculation at the end.

However, it's **far easier** to skip that separate schedule and add NOLs as a non-core-business Asset in this calculation at the end.

Beyond the extra work, one problem with the first approach is that you may not **use** all the NOLs by the end of the explicit forecast period!

10. How does the Pension Expense factor into Free Cash Flow?

There are several different components of the Pension Expense, including the Service Cost, the Interest Expense, the *Expected* Return on Plan Assets, the Amortization of Net Losses or Gains, and Other Adjustments.

Most of those count as **operating expenses** and should be reflected in the company's Free Cash Flow.

In an Unlevered DCF, you should **exclude** the Interest Expense and Expected Return on Plan Assets within the Pension Expense and then subtract the Unfunded portion of the Pension Obligation when moving from Implied Enterprise Value to Implied Equity Value.

Some companies embed these items within Operating Expenses on the Income Statement, so you may have to review the filings to calculate EBIT properly.

You may have to multiply the Unfunded Pension by (1 – Tax Rate) as well, though the treatment differs under U.S. GAAP and IFRS and in different countries.

11. Should you ever include items such as asset sales, impairments, or acquisitions in FCF?

For the most part, no. You certainly **shouldn't** make speculative projections for these items – they are all non-recurring, so it's not correct to forecast them as if they were recurring, predictable items.

If a company has announced plans to sell an asset, make an acquisition, or record a write-down **in the near future**, then you might factor it into FCF for that year.

And if it's an acquisition or divestiture, you'll have to adjust FCF to reflect the cash spent or received, and you'll have to change the company's revenue and expenses in future periods.

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DCF Analysis – Discount Rates and WACC

Questions related to the Discount Rate and WACC in a DCF are surprisingly tricky because it's not always so easy to explain how all the items are linked.

You don't need to know every single detail of these calculations in special cases, such as multinationals operating across borders, but you should know the **intuition** behind everything.

If you know that the Discount Rate represents the opportunity cost and that different levels of Debt and Equity affect *all* the investors, you can answer many of these questions.

1. What does the Cost of Equity mean intuitively?

It tells you the percentage a company's stock "should" return each year, over the very long term, also factoring in dividends and stock repurchases.

In a valuation, it represents the percentage an Equity investor might earn each year.

To a company, Cost of Equity represents the cost of funding its operations by issuing shares to new investors.

The company "pays for" Equity via potential Dividends (a real cash expense) and also by diluting existing investors (and thereby giving more stock appreciation potential to others).

2. What does WACC mean intuitively?

WACC is similar to Cost of Equity, but it's the expected annual return percentage if you invest proportionately in *all* parts of the company's capital structure – Debt, Equity, Preferred Stock, etc.

To a company, WACC represents the cost of funding its operations by using **all** its sources of capital.

Investors might invest in a company if their expected IRR exceeds WACC, and a company might decide to fund a new project, acquisition, or expansion if its expected IRR exceeds WACC.

3. How do you calculate Cost of Equity?

Cost of Equity = Risk-Free Rate + Equity Risk Premium * Levered Beta

The Risk-Free Rate represents what you would earn on "risk-free" government bonds denominated in the same currency as the company's cash flows. You usually use 10-year or 20-year bonds to match the explicit forecast period of the DCF.

Levered Beta represents how volatile this stock is relative to the market as a whole, factoring in both its **intrinsic risk** and the **risk from leverage**.

And the Equity Risk Premium represents how much the stock market in the company's country will return above the "risk-free" government bond.

The idea is to say: **"Stocks are riskier and have higher potential returns than government bonds. So let's take the rate of return on those government bonds, add the *extra* returns you could get from the stock market, and then adjust for *this company's* specific risk/return."**

4. If a company operates in the EU, U.S., and U.K., what should you use for its Risk-Free Rate?

You should use the rate on the government bonds that match the currency of the company's cash flows.

So if the company reports its financials in USD, you might use the 10-year U.S. Treasury Rate; if it reports them in EUR or GBP, you might use the rate on 10-year notes issued by the Bank of England or the European Central Bank.

5. What should you use for the Risk-Free Rate if government bonds in the country are NOT risk-free (e.g., Greece)?

One option is to take the Risk-Free Rate in a country that is assumed to be "risk-free," like the U.S. or U.K., and then add a **default spread** based on your country's credit rating.

For example, you might start with a rate of 2.5% for 10-year U.S. Treasuries and then add a spread of 11.2% for Greece based on its current credit rating.

That rate of 13.7% represents how yields are much higher in Greece due to the significant chance of the government defaulting on its bonds.

6. How do you calculate the Equity Risk Premium?

There is almost no agreement on how to do it because stock-market returns differ based on the period and whether you use an arithmetic mean, a geometric mean, or other approaches.

Many firms use a publication called "Ibbotson's" that publishes Equity Risk Premium data for companies of different sizes in different industries each year.

You could also take the historical data for the U.S. stock market and add a premium based on the default spread of your country/market.

For example, if the historical U.S. premium is 7%, you might add 3% if your country's credit rating is Ba2 and that rating corresponds to a 3% spread.

Finally, some groups just use a "standard" number for each market, such as 6-7%.

7. How do you calculate the Equity Risk Premium for a multinational company that operates in many different geographies?

You might take the percentage revenue from each country, multiply it by the ERP in that market, and then add everything up to get a weighted average.

The ERP in each market might be based on anything described above, but the "Historical U.S. stock market returns + default spread" approach is common.

8. What does Beta mean intuitively?

Levered Beta tells you how volatile a company's stock price is relative to the stock market as a whole, factoring in both the **intrinsic business risk** and the **risk from leverage** (i.e., Debt).

If Beta is 1.0, when the market goes up 10%, this company's stock price also goes up by 10%.

If Beta is 2.0, when the market goes up 10%, this company's stock price goes up by 20%.

Unlevered Beta excludes the risk from leverage and reflects only the intrinsic business risk, so it's always less than or equal to Levered Beta.

9. Could Beta ever be negative?

Yes, it's possible. The company's stock price has to move in *the opposite direction* of the market as a whole for Beta to be negative.

Gold is commonly cited as an Asset that has a negative Beta because it often performs better when the stock market declines.

However, negative Betas for *companies* are quite rare and usually revert to positive figures, even if they're negative for short periods.

10. Why do you have to un-lever and re-lever Beta when calculating Cost of Equity?

You don't "have to" un-lever and re-lever Beta: You could just use the company's *historical* Beta, i.e. its own Levered Beta, and skip this step.

But in a valuation, you're estimating the company's **Implied Value** – what it *should be worth*.

If you use the historical Beta, that corresponds more closely to the company's Current Value – what the market says it's worth *today*.

By un-levering Beta for each comparable company, you isolate each company's **inherent business risk**.

Each company might have a different capital structure, so it's important to isolate that risk and remove the risk from leverage.

You then take the median Unlevered Beta from these companies and re-lever it based on the targeted capital structure of *the company you're valuing*.

You do this because, **in reality**, there will always be business risk and risk from leverage, and so you need to reflect both for the company you're valuing.

You can think of the result – Re-Levered Beta – as: "What the **volatility** of this company's stock price, relative to the market as a whole, *should be*, based on the median business risk of its peer companies and this company's targeted capital structure."

11. What are the formulas for un-levering and re-levering Beta, and what do they mean?

Assuming the company has only Equity and Debt:

Unlevered Beta = Levered Beta / (1 + Debt/Equity Ratio * (1 – Tax Rate))

Levered Beta = Unlevered Beta * (1 + Debt/Equity Ratio * (1 – Tax Rate))

If the company has Preferred Stock, you add another term for the Preferred/Equity Ratio.

You use a "1 +" in front of Debt/Equity Ratio * (1 – Tax Rate) to ensure that Unlevered Beta is always less than or equal to Levered Beta.

And you multiply the Debt/Equity Ratio by (1 – Tax Rate) because the tax-deductibility of interest reduces the risk of Debt.

The formulas *reduce* Levered Beta to represent the *removal* of risk from leverage, but they *increase* Unlevered Beta to represent the *addition* of risk from leverage.

12. In those formulas, you're not factoring in the interest rate on Debt. Isn't that wrong? More expensive Debt should be riskier.

Yes, this is one drawback of this approach. However:

1. **The Debt / Equity ratio is a proxy for interest rates on Debt** because companies with high Debt / Equity ratios tend to have higher interest rates as well.

2. **The risk isn't directly proportional to interest rates**. Higher interest on Debt will result in lower coverage ratios (EBITDA / Interest) and, therefore, more risk, but it's not as simple as saying, "Interest is now 4% rather than 1% – risk is 4x higher."

4x higher interest might barely change a large company's financial profile, but it might make a much bigger difference for a smaller company.

13. Do you still un-lever and re-lever Beta even when you're using Unlevered FCF?

Yes. **Un-levering and re-levering Beta has nothing to do with Unlevered vs. Levered FCF.**

A company's capital structure affects both the Cost of Equity and WACC, so you un-lever and re-lever Beta regardless of the type of cash flow in your analysis.

14. What are some different ways to calculate Beta in the Cost of Equity calculation?

Some people argue that you should use *Predicted Beta* instead of Historical Beta because Cost of Equity relates to *expected future returns*.

If you do use historical data, you could use the company's own Historical Beta or the re-levered Beta based on the historical performance of comparable companies.

And if you re-lever Beta, you could do it based on the company's current capital structure or its targeted or "optimal" capital structure.

Most of these methods will produce similar results, and you always use a *range* of values when calculating Cost of Equity and WACC.

15. How would you estimate the Cost of Equity for a U.S.-based technology company?

This question tests your ability to make a guesstimate based on common sense and your knowledge of current market rates.

You might say, "The Risk-Free Rate is around 1.5% for 10-year U.S. Treasuries. A tech company like Salesforce is more volatile than the market as a whole, with a Beta of around 1.5. So if you assume an Equity Risk Premium of 8%, Cost of Equity might be around 13.5%."

The numbers will change based on market conditions, but that's the idea.

16. How do you calculate WACC, and what makes it tricky?

The *formula* for WACC is simple:

WACC = Cost of Equity * % Equity + Cost of Debt * (1 – Tax Rate) * % Debt + Cost of Preferred Stock * % Preferred Stock

But it's tricky to calculate because there's ambiguity with many of these items:

1. **Cost of Debt:** Do you use the weighted average coupon rate on the company's bonds? Or the Yield to Maturity (YTM)? Or the YTM of Debt from comparable companies?

2. **Percentages of Debt, Equity, and Preferred Stock:** Do you use the company's current capital structure, "optimal" structure, or targeted structure?

3. **Cost of Equity:** There are different ways to calculate Beta, and no one agrees on the Equity Risk Premium.

17. WACC reflects the company's capital structure, so why do you pair it with Unlevered FCF? It's not capital structure-neutral!

That's not the best way to think about this concept. Think of Unlevered FCF as "Free Cash Flow to Firm," or FCFF, instead (as that is the alternate name for it).

And think of the relationship as: "Unlevered FCF, or FCFF, is available to **ALL** investors, and WACC represents **ALL** investors."

No Discount Rate can be capital structure-neutral since each part of a company's capital structure affects the other parts. So "capital structure neutrality" is a property of Free Cash Flow and its variants.

18. Should you use the company's current capital structure or optimal capital structure to calculate WACC?

A company's "optimal" capital structure is the one that minimizes WACC. But there's no way to calculate it because you can't tell *in advance* how the Costs of Equity and Debt will change as the capital structure changes.

So in practice, you'll often use the median capital structure percentages from the comparable public companies as a proxy for the "optimal" capital structure.

The logic is the same as the logic for un-levering and re-levering Beta: You want to capture what this company's capital structure *should be*, not what it is right now.

It's better to use this *expected* capital structure because the company's Implied Value in a DCF is based on its *expected*, future cash flows.

19. Should you use Total Debt or Net Debt to determine the capital structure percentages in the WACC calculation?

Some textbooks claim that you should use Equity Value + Debt + Preferred Stock – Cash for the denominator of the capital structure percentages in the WACC formula rather than Equity Value + Debt + Preferred Stock.

However, we **disagree** with this approach for several reasons:

1) **Cash Does Not "Offset" Debt** – For example, many forms of Debt do not allow for early repayment or penalize the company for early repayment. So a high Cash balance doesn't necessarily reduce the risk of Debt.

2) **You May Get Nonsensical Results with High Cash Balances** – For example, if the company's Cash balance exceeds its Debt balance, Debt as a Percentage of Total Capital will be far too low. This will artificially *inflate* the Discount Rate since Equity is more expensive than Debt for most companies.

20. Why is Equity more expensive than Debt?

Because it offers higher risk and higher potential returns.

Expected stock market returns exceed the interest rates on Debt in most cases, which already makes the Cost of Equity higher. But interest on Debt is also tax-deductible, which further reduces its cost.

In developed markets like the U.S., the average annual stock market return is around 10-11%. So a company with a Beta of 1.0 will have a Cost of Equity in that range.

For Cost of Debt to be higher, the *Pre-Tax Cost* would have to be ~17-18% at a 40% tax rate. And hardly any Debt has interest rates that high.

21. How does the Cost of Preferred Stock compare with the Costs of Debt and Equity?

Preferred Stock tends to be more expensive than Debt but less expensive than Equity: It offers higher risk and potential returns than Debt, but lower risk and potential returns than Equity.

That's because the coupon rates on Preferred Stock tend to be higher than the interest rates on Debt, and Preferred Dividends are **not** tax-deductible.

But these rates are still lower than expected stock market returns, and the risk is also lower since Preferred Stock investors have a higher claim on the company's Assets than Common Stock investors.

22. How do you determine the Cost of Debt and Cost of Preferred Stock in the WACC calculation, and what do they mean?

These Costs represent the marginal rates a company would pay if it issued *additional* Debt or Preferred Stock.

There is no way to observe these rates, but you can estimate them.

One simple method is to calculate the weighted average coupon rate on the company's existing Debt or Preferred Stock or to calculate the median coupon rate on the outstanding issuances of comparable companies.

You could also use the Yield to Maturity (YTM) instead, which reflects the market prices of the bonds (a bond with a coupon rate of 5% that's trading at a discount to par value will have a YTM higher than 5%).

You could also take the Risk-Free Rate in the country and add a **default spread** based on the company's expected credit rating if it issues more Debt or Preferred Stock (e.g., if you think its credit rating will go from BB+ to BB after issuing Debt, you'd calculate the average spread for BB+-rated companies and add it to the Risk-Free Rate).

23. How do convertible bonds factor into the WACC calculation?

If the company's current share price exceeds the conversion price of the bonds, you count the bonds as Equity and factor them in by using a higher diluted share count, resulting in a higher Equity Value for the company and a greater Equity weighting in the WACC formula.

If not – i.e., the bonds are **not** currently convertible – you count them as Debt and use the coupon rate (or YTM, or another method above) to calculate their Cost.

Convertible bonds almost always reduce WACC when they count as Debt since the Cost of Debt is lower than the Cost of Equity, and the coupon rates on convertible bonds are even lower than the rates on traditional bonds.

NOTE: This answer assumes that you're calculating WACC based on the company's *current* capital structure. If you're using the optimal or targeted structure, *the company's* convertible bonds won't factor in.

24. How do the Cost of Equity, Cost of Debt, and WACC change as a company uses more Debt?

The Cost of Equity and Cost of Debt **always increase** because more Debt increases the risk of bankruptcy, which affects all investors.

As a company goes from no Debt to some Debt, WACC decreases at first because Debt is cheaper than Equity, but it starts increasing at higher levels of Debt as the risk of bankruptcy starts to outweigh the lower Cost of Debt.

However, the exact impact depends on where you are on that curve. If the company already has a very high level of Debt, WACC is likely to increase with more Debt; at lower levels of Debt, WACC is more likely to decrease with more Debt.

25. How do all those figures change as the company uses less Debt?

The Cost of Equity and Cost of Debt decrease for the reasons stated above: Less Debt means a lower risk of bankruptcy and, therefore, less risk for *all* investors.

WACC could go either way depending on where you are on the curve. If the company already has a very high level of Debt, WACC will likely decrease with less Debt; if its Debt level is much lower, WACC will likely increase with less Debt.

26. If a company previously used 20% Debt and 80% Equity, but it just paid off all its Debt, how does that affect WACC?

It depends on how you're calculating WACC. If you're using the company's *current* capital structure, WACC will *most likely* increase because 20% Debt is a fairly low level. At that level, less Debt will most likely increase WACC.

But if you're using the targeted, optimal, or median capital structure from the comparable companies, this change won't affect WACC because you're not using the company's current capital structure at all.

27. Should you ever use *different* Discount Rates for different years in a DCF?

Yes, sometimes it makes sense to use different Discount Rates.

For example, if a company is growing quickly right now, but it's expected to mature and grow more slowly in the future, you might use decreasing Discount Rates.

So if the company's current WACC is between 11% and 13%, and WACC for mature companies in the industry is between 8% and 9%, you might start out at 12% and then reduce it by 0.5% in each year of the explicit forecast period until it reaches 8.5% at the end.

It makes less sense to do this if the company is already stable and mature and it's not expected to change much over time.

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DCF Analysis – Calculating the Terminal Value

Many guides and textbooks explain **Terminal Value** poorly and tend to focus on the basics, such as the different ways to calculate it.

We believe it's more important to understand the **trade-offs** of the methods and how to use them to cross-check your work, which is why most of the questions here go beyond the basics.

1. What is the difference between the explicit forecast period and the Terminal Period in a DCF?

The company's Free Cash Flow growth rate, and possibly its Discount Rate, change over time in the explicit forecast period since you forecast cash flow in each year.

But in the Terminal Period, you assume the company remains in a "steady state": Its Free Cash Flow grows at the same rate each year, and its Discount Rate remains the same.

2. What's the intuition behind the Gordon Growth formula for Terminal Value?

The typical formula is:

Terminal Value = Final Year FCF * (1 + Terminal FCF Growth Rate) / (Discount Rate – Terminal FCF Growth Rate)

But it's more intuitive to think of it as:

Terminal Value = FCF in Year 1 of Terminal Period / (Discount Rate – Terminal FCF Growth Rate)

The intuition is that a company is **worth less** if the Discount Rate is higher and **worth more** if the Terminal FCF Growth Rate is higher.

For example, let's say the company's FCF is not growing, and its Discount Rate is 10%. It has $100 in FCF in the first year of the Terminal Period.

You would be willing to pay $100 / 10%, or $1,000, so the Terminal Value is $1,000. If the Discount Rate falls to 5%, now you'd pay $100 / 5%, or $2,000. If it increases to 20%, you'd pay $100 / 20%, or $500.

That's because the company is **worth more** when you have *worse* investment options elsewhere, and **worth less** when you have *better* investment options elsewhere.

Now let's say the company's FCF is growing. If it grows by 3% per year, you'd be willing to pay $100 / (10% – 3%), or ~$1,429 for it. But if its FCF growth rate increases to 5% per year, you'd be willing to pay $100 / (10% – 5%), or $2,000, for it.

Higher growth lets you achieve the same targeted return even when you pay more.

3. If you use the Multiples Method to calculate Terminal Value, do you use the multiples from Public Comps or Precedent Transactions?

The answer is: "Neither one – you just use them as *starting points* in the analysis, and then you adjust once you see the Terminal FCF Growth Rates that the selected multiples imply."

It's better to *start with* the multiples from the Public Comps, ideally the ones from 1-2 years into the future, because you **don't** want to reflect the control premium inherent in Precedent Transactions.

The company doesn't necessarily "get sold" at the end of the forecast period; the Terminal Multiple is just an abbreviated way of expressing its valuation.

Then, if the multiples imply a reasonable Terminal FCF Growth Rate, you might stick with your initial guess; if not, you adjust it up or down as necessary.

4. How do you pick the Terminal Growth Rate when you calculate the Terminal Value using the Gordon Growth Method?

This growth rate should be *below* the country's long-term GDP growth rate and in-line with other macroeconomic variables like the rate of inflation.

For example, if you're in a developed country where the long-term expected GDP growth is 3%, you might use numbers ranging from 1.5% to 2.5% for the range of Terminal Growth Rates.

You should **NOT** pick a rate above the country's long-term GDP growth rate because the company will become bigger than the economy as a whole after a certain point!

5. Why do you need to discount the Terminal Value back to its Present Value?

Because the Terminal Value represents the Present Value of the company's cash flows from the very *end* of the explicit forecast period into perpetuity. In other words, it represents the company's **value IN a future period AT a point in the future**.

Valuation tells you what a company is worth **TODAY**, so any "future value" must always be discounted back to its Present Value.

If you did **not** discount the Terminal Value, you'd greatly overstate the company's Implied Value because you'd be acting as if its Year 6, 11, or 16 cash flows arrived *next year*.

6. When you discount the Terminal Value, why do you use the number of the last year in the forecast period for the discount period (for example, 10 for a 10-year forecast)?

Shouldn't you use 11 since Terminal Value represents the Present Value of cash flows starting in Year 11?

No. The Terminal Value does represent the Present Value of cash flows *starting* in Year 11, but it's the Present Value *as of the very end of Year 10*.

You would use 11 for the discount period only if your explicit forecast period went to Year 11 and the Terminal Period started in Year 12.

7. What do you do after summing the PV of Terminal Value and PV of Free Cash Flows?

If you're building a Levered DCF analysis, you're almost done because this summation gives you the company's Implied Equity Value. The last step is to divide the company's Implied Equity Value by its diluted share count to get its Implied Share Price (if the company is public).

In an Unlevered DCF, the PV of Terminal Value + PV of Free Cash Flows = Implied Enterprise Value, so you have to "back into" the company's Implied Equity Value and then calculate its Implied Share Price.

You do this by *adding* non-core-business Assets (Cash, Investments, etc.) and *subtracting* Liability and Equity items that represent other investor groups (Debt, Preferred Stock, Noncontrolling Interests, etc.).

Then, you divide by the company's diluted share count to get its Implied Share Price.

8. The diluted share count factors in the company's *in-the-money* options.

But what about its *out-of-the-money options*? Shouldn't you account for them in a DCF?

In theory, yes. Some academics and professors such as Damodaran use Black-Scholes to value these out-of-the-money options, and then subtract the value of those options to determine its true Implied Equity Value.

In practice, banks rarely include out-of-the-money options in a DCF. There are several reasons why, including the fact that these options tend to make a very small impact and the fact that the valuation of options gets tricky and requires inputs that you may or may not have.

9. How can you check whether or not your Terminal Value estimate is reasonable?

It's an iterative process: You start by entering a range of assumptions for the Terminal Multiple or Terminal FCF Growth Rate, and then you cross-check your assumptions by seeing what Growth Rates or Multiples they *imply*.

If it seems wrong, then you adjust the range of Terminal Multiples or Terminal FCF Growth Rates up or down until you get more reasonable results.

Example: You start by picking 10x EV / EBITDA for the Terminal Multiple. At a Discount Rate of 12%, this multiple implies a Terminal FCF Growth Rate of 5%, which is too high.

So you reduce it to 6x EV / EBITDA, but now the Implied Terminal FCF Growth Rate drops to 1%, which is too low.

So you guess 8x EV / EBITDA, which implies a Terminal FCF Growth Rate of 2.3%. That is more reasonable since it's below the expected long-term GDP growth rate.

This 8x figure might be your "Baseline Terminal Multiple," so you start there and then go slightly above and below it in sensitivity tables.

10. What's one problem with using EV / EBITDA multiples to calculate Terminal Value?

The biggest issue is that EV / EBITDA ignores CapEx. So two companies with similar EV / EBITDA multiples might have very different Free Cash Flow and FCF growth figures. As a result, their Implied Values might differ significantly even if one multiple is similar for both of them.

You may get better results by using EV / EBIT, EV / NOPAT, or EV / Unlevered FCF, but those present other issues, such as less comparability across peer companies.

This problem is one reason why the Gordon Growth Method is still the "real" way to calculate Terminal Value.

11. Would it ever make sense to use a negative Terminal FCF Growth Rate?

Yes. For example, if you're valuing a biotech or pharmaceutical company and the patent on its key drug expires within the explicit forecast period, you might assume that the company's cash flows eventually decline to 0.

A negative Terminal FCF Growth Rate represents your expectation that the company will stop generating cash flow eventually.

A negative Terminal FCF Growth Rate doesn't make the company "worthless"; it just means that the Terminal Value will be much lower.

12. How can you determine which assumptions to analyze in sensitivity tables for a DCF?

The same variables are important in any DCF: The Discount Rate, the Terminal FCF Growth Rate or Terminal Multiple, and the revenue growth and margin assumptions.

It doesn't make sense to sensitize much else – assumptions for CapEx and Working Capital, for example, make a very small difference.

There may also be industry-specific assumptions that are worth sensitizing (e.g., the patent expiration date for a drug in biotech/pharmaceuticals).

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DCF Analysis – More Advanced Features

You're **unlikely** to get questions on these topics unless you have significant work experience related to valuation.

The most important questions within this subject relate to the mid-year convention and stub periods; they can be a bit tricky to think through mathematically, so it helps to complete a few examples yourself.

1. Why do you use the mid-year convention in a DCF analysis?

You use it because a company's cash flow does not arrive 100% at the end of each year – it's generated *throughout* each year.

Using 1, 2, 3, 4, etc. for the discount periods implies that the first cash flow arrives after *one entire year* has passed.

But if you use 0.5, 1.5, 2.5, 3.5, etc. instead, you assume that only *half a year* passes before the first cash flow is generated, which is a better approximation for real life.

2. What impact does the mid-year convention make?

A DCF that uses the mid-year convention will produce **higher Implied Values** because the discount periods are lower. As a result, a formula like this:

Present Value = $100 / ((1 + 10%) ^ Year#)

Will produce **higher values** because the Year # of the first period would be 1 without the mid-year convention, but 0.5 *with* the mid-year convention.

3. Why might you include a "stub period" in a DCF, and what does it mean?

You include a "stub period" if you're valuing a company midway through the year, and it has already reported some of its financial results.

A DCF is based on *expected future cash flow*, so you should **exclude** these previously reported results and adjust the discount periods as well.

For example, maybe it's September 30th and the company's fiscal year ends on December 31st.

The company's *future cash flow* for this year will be generated between September 30th and December 31st.

It's incorrect to include the cash flow from January 1st to September 30th since that part of the year has already passed.

So for the first year in the analysis, you include only the expected FCF from September 30th to the end of the year. To discount the FCF in that 3-month period, you use 0.25 for the discount period since 3 months is 25% of the year.

You then use 1.25 for the discount period of the next year, 2.25 of the year after that, and so on.

4. You're valuing a company on April 30th, and you want to include both the stub period and the mid-year convention in your analysis.

How would you change the company's Free Cash Flow, and which discount periods would you use?

For the FCF, you exclude everything generated between January 1st and April 30th and include **only** the projected amount to be generated between April 30th and December 31st.

Since most companies report only quarterly results, you'll most likely be excluding the **first quarter**, not exactly the first 4 months.

If you include both the stub period and the mid-year convention, you divide the stub period of the first year by 2. And then in each year after that, you subtract 0.5 from the "normal" discount period.

In this case, April 30th is 1/3 through the year. Two-thirds of the year remains, so the "normal" stub discount period is 0.67.

Since you're using the mid-year convention, you divide that by 2 to get 0.34. You then use that period to discount the company's FCF from April 30th to December 31st.

The "normal" discount period of the next year would be 0.67 + 1.00, or 1.67. So you take the 1.67 and subtract 0.50 to get 1.17.

For the next year after that, the "normal" discount period is 0.67 + 2.00, or 2.67, so you subtract 0.50 and get 2.17. You continue that for the rest of the years.

5. Continuing with the same example, how do the Terminal Value and PV of Terminal Value calculations change with this April 30th valuation?

It depends on how you calculate the Terminal Value. With the **Multiples Method**, the Terminal Value calculation stays the same since it's based on the company's EBITDA (or other metric) in the final projection year times an appropriate multiple.

When you discount the Terminal Value, the stub period affects the discount period, but the mid-year convention does not because the Terminal Value is **as of the END of the last projection year**.

So if the valuation date is April 30th, and there are 10 years in the projection period, you use 9.67 for the discount period to calculate the PV of the Terminal Value.

With the **Gordon Growth method**, if you're using the mid-year convention, you must **adjust** the Terminal Value by multiplying it by (1 + Discount Rate)^0.5.

You have to do this because the normal formula, FCF in Year 1 of Terminal Period / (Discount Rate – Terminal Growth Rate), gives you the Present Value at **Year 10.5** if you're using the mid-year convention.

When you multiply by (1 + Discount Rate)^0.5, you "move the Terminal Value back" to the end of Year 10.

Discounting the Terminal Value works the same way as it does with the Multiples Method: Only the stub period affects it. So you use also 9.67 for the discount period.

6. Why do you need to adjust the Terminal Value when you use the mid-year convention? Can't you just discount it to Present Value using a different discount period?

Yes, you could discount the Terminal Value to its Present Value by using a different discount period instead.

However, the Terminal Values calculated via both methods should be **directly comparable**.

In other words, **BOTH** Terminal Values should be as of the end of Year 10 in a 10-year analysis.

If you do *not* adjust the Terminal Value from the Gordon Growth Method, and you're using the mid-year convention, you can't compare it to the Terminal Value from the Multiples Method because one TV is as of Year 10, and the other is as of Year 10.5.

7. Why might you need to create a "Normalized Terminal Year" in a DCF?

You might create a Normalized Terminal Year if something about the company's revenue growth, margins, or CapEx is expected to change in a major way in the Terminal Period.

As a result of this change, multiplying FCF in the final projection year by (1 + Terminal FCF Growth Rate) won't produce accurate results in the Terminal Value formula.

For example, a key patent might expire in Year 9 or 10, or the company might have a huge Intangibles balance that gets completely amortized in Year 10.

You use the FCF *in this Normalized Year* for the Terminal Value calculation rather than multiplying Final Year FCF by (1 + Terminal FCF Growth Rate).

8. What impact does the Normalized Terminal Year make?

Technically, it could go either way, but in *most* cases, the Normalized Terminal Year will reduce a company's Implied Value because you often **adjust down** the company's growth rates and margins in this year.

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Factors That Affect a DCF Analysis

This section is short because so much of it has been covered in the previous sections.

Interviewers like to ask these questions because they test whether or not **you understand the big picture**.

Anyone can memorize how to walk through a DCF, but you can answer these questions only if you understand the underlying concepts.

1. Which assumptions make the biggest impact on a DCF?

The **Discount Rate** and **Terminal Value** make the biggest impact on the DCF output.

That's because the Discount Rate affects the PV of everything and because the PV of the Terminal Value often represents 50%+ of the company's Implied Value.

The assumptions for revenue growth and operating margins also make a significant impact, but less so than the ones above. Other items, such as CapEx, Working Capital, and non-cash adjustments, make a much smaller impact.

2. Should Cost of Equity and WACC be higher for a $5 billion or $500 million Equity Value company?

Assuming that both companies *have the same capital structure percentages*, Cost of Equity and WACC should both be higher for the $500 million company.

All else being equal, smaller companies tend to offer higher potential returns and higher risk than larger companies, which explains why Cost of Equity will be higher.

Since smaller companies have a higher chance of defaulting on their Debt, their Cost of Debt (and Preferred) also tends to be higher.

And since all the Costs tend to be higher for smaller companies, WACC must be higher, *assuming the same capital structure percentages*.

3. Would increasing the revenue growth from 9% to 10% or increasing the Discount Rate from 9% to 10% make a bigger impact on a DCF?

The Discount Rate increase will make a bigger impact. Increasing revenue growth from 9% to 10% will barely impact FCF and the Terminal Value, but the Discount Rate will affect the Present Value of everything.

4. Would it make a bigger impact to increase revenue growth from 9% to 20%, or to increase the Discount Rate from 9% to 10%?

It's harder to tell here. More than doubling a company's revenue growth could make a bigger impact than changing the Discount Rate by 1%, but when the changes are this different, you'd have to run the numbers to tell for sure.

These operational changes make a bigger impact over *longer* projection periods than they do over shorter ones, so you would see more of a difference for a 10-year DCF than a 5-year one.

5. Two companies produce identical total Free Cash Flows over a 10-year period, but Company A generates 90% of its Free Cash Flow in the first year and 10% over the remaining 9 years. Company B generates the same amount of Free Cash Flow in each year.

Which company will have the higher Implied Value?

This is a bit of a trick question because it depends on what you count toward the Implied Value. If it's **just** this series of cash flows, Company A will have the higher Implied Value because of the time value of money: The cash flows arrive earlier on, so they're worth more.

However, Company B will almost certainly have a much higher Terminal Value because it has higher FCF in Year 10.

So if the Terminal Value comprises a big portion of the Implied Value, and you count it in the analysis, it's a good bet that **Company B** will have the higher Implied Value.

6. How do higher vs. lower tax rates affect the Cost of Equity, Cost of Debt, WACC, and the Implied Value from a DCF?

The tax rate affects the Cost of Equity, Cost of Debt, and WACC **only if the company has Debt**. If the company does not have Debt, or its targeted/optimal capital structure does not include Debt, the tax rates don't matter because there's no tax benefit to interest paid on Debt.

Assuming there's some Debt, a higher tax rate will **reduce** Cost of Equity, Cost of Debt, and WACC.

It's easy to see why it reduces the Cost of Debt: Since you multiply by (1 – Tax Rate), a higher rate always reduces the after-tax cost.

But it also reduces the Cost of Equity for the same reason: With a greater tax benefit, Debt is less risky even to Equity investors. And if both of these are lower, WACC will also be lower.

However, the **Implied Value from a DCF** will be **lower** because the higher tax rate reduces FCF and, therefore, the company's Terminal Value. Those changes tend to outweigh a lower WACC.

The opposite happens with lower taxes: Higher Costs of Equity and Debt, higher WACC, and a higher Implied Value from the DCF.

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Public Comps and Precedent Transactions

This section is relatively short because much of it was covered in the interview questions on Equity Value, Enterprise Value, and Valuation Multiples.

Public Comps and Precedent Transactions relate to how you *use* valuation multiples in real life.

So if you already understand what multiples mean and how to calculate them, you just need to understand the mechanics and execution to answer these questions.

1. Can you walk me through how you use Public Comps and Precedent Transactions?

First, you select the companies and transactions based on criteria such as industry, size, and geography.

Then, you determine the appropriate metrics and multiples for each set – for example, revenue, revenue growth, EBITDA, EBITDA margins, and revenue and EBITDA multiples – and you calculate them for all the companies and transactions.

Next, you calculate the minimum, 25th percentile, median, 75th percentile, and maximum for each valuation multiple in the set.

Finally, you apply those numbers to the financial metrics of the company you're analyzing to estimate its Implied Value.

For example, if the company you're valuing has $100 million in EBITDA and the median EBITDA multiple of a set of comparable companies is 7x, its implied Enterprise Value is $700 million based on that.

You then calculate its Implied Value for all the other multiples to get a range of values.

2. Why is it important to select Public Comps and Precedent Transactions that are similar?

Because the comparable companies and transactions should have **similar Discount Rates**.

Remember that a company's valuation multiples depend on its Free Cash Flow, Discount Rate, and Expected FCF Growth Rate.

If the companies in your set all have similar Discount Rates, it's easier to conclude that one company has a higher multiple *because* its expected growth rate is higher.

If they don't have similar Discount Rates, it's harder to draw meaningful conclusions.

3. How do you select Comparable Companies and Precedent Transactions?

You screen based on **geography**, **industry**, and **size**, and also **time** for Precedent Transactions.

The most important factor is **industry** – you'll always use that because it makes no sense to compare a mobile gaming company to a steel manufacturing company.

Here are a few example screens:

- **Comparable Company Screen:** U.S.-based steel manufacturing companies with over $500 million in revenue.
- **Comparable Company Screen:** European legacy airlines with over €1 billion in EBITDA.
- **Precedent Transaction Screen:** Latin American M&A transactions over the past 3 years involving consumer/retail sellers with over $1 billion USD in revenue.
- **Precedent Transaction Screen:** Australian M&A transactions over the past 2 years involving infrastructure sellers with over $200 million AUD in revenue.

4. Are there any screens you should AVOID when selecting Comparable Companies and Precedent Transactions?

You should **avoid** screening by *both* financial metrics *and* Equity Value or Enterprise Value.

For example, you should **NOT** use this screen: "Companies with revenue under $1 billion and Enterprise Values above $2 billion."

If you do that, you're **artificially constraining the multiples** because EV / Revenue must be above 2x for every company in the set.

5. Both Public Comps and Precedent Transactions seem similar. What are the main differences?

The idea is similar – you use *Current* valuation multiples from similar companies or deals to value a company – but the execution is different.

Here are the differences for Precedent Transactions:

- **Screening Criteria:** In addition to industry, size, and geography, you also use **time** because you only want transactions from the past few years. You might also use **Transaction Size**, and you might use broader screening criteria in general.

- **Metrics and Multiples:** You focus more on **historical metrics and multiples**, especially LTM revenue and EBITDA as of the announcement date.

- **Calculations:** All the multiples are based on the purchase price as of the announcement date of the deal.

- **Output:** The multiples produced tend to be higher than the multiples from Public Comps because of the **control premium**. But the multiples also tend to span wider ranges because deals can be done for *many* different reasons.

6. Can you walk me through the process of finding market and financial information for the Public Comps?

You start by finding each company's most recent annual and interim (quarterly or half-year) filing. You calculate its diluted share count and Current Equity Value and Current Enterprise Value based on the information there and its most recent Balance Sheet.

Then, you calculate its Last Twelve Months (LTM) financial metrics by taking the most recent annual results, adding the results from the most recent partial period, and subtracting the results from the same partial period the *last year*.

For the projected figures, you look in equity research or find consensus figures on Bloomberg. And then you calculate all the multiples by dividing Current Equity Value or Current Enterprise Value by the appropriate metric.

7. Can you walk me through the process of finding market and financial information for the Precedent Transactions?

You find the acquired company's filings from *just before* the deal was announced, and you calculate the LTM financial metrics in the same way using those.

To calculate the company's Equity Value and Enterprise Value, you use the purchase price the acquirer paid, and you move from Equity Value to Enterprise Value in the same way you usually do, using the company's most recent Balance Sheet as of the announcement date.

You calculate all valuation multiples in the same way, using Transaction Equity Value or Transaction Enterprise Value as appropriate.

8. How do you decide which metrics and multiples to use in these methodologies?

You usually look at a sales-based metric and its corresponding multiple and 1-2 profitability-based metrics and multiples. For example, you might use Revenue, EBITDA, and Net Income, and the corresponding multiples: EV / Revenue, EV / EBITDA, and P / E.

You do this because you want to value a company in relation to how much it sells and to how much it *keeps* of those sales.

Sometimes, you'll drop the sales-based multiples and focus on profitability or cash flow-based ones (e.g., EBIT, EBITDA, Net Income, Free Cash Flow, etc.).

9. Why do you look at BOTH historical and projected metrics and multiples in these methodologies?

Historical metrics are useful because they're based on what actually happened, but they can also be deceptive if there were non-recurring items or if the company made acquisitions or divestitures.

Projected metrics are useful because they assume the company will operate in a "steady state," without acquisitions, divestitures, or non-recurring items, but they're also less reliable because they're based on predictions of the future.

10. When you calculate forward multiples for the comparable companies, should you use each company's Current Equity Value or Current Enterprise Value, or should you project them to get the Year 1 or Year 2 values?

No, you **always** use the Current Equity Value or Current Enterprise Value. **NEVER "project" either one.**

A company's share price, and, therefore, both of these metrics, is based on past performance and future expectations.

So to "project" these metrics, you'd have to jump into the future and see what future expectations are at *that* point, which doesn't make sense.

11. What should you do if some companies in your set of Public Comps have fiscal years that end on June 30th and others have fiscal years that end on December 31st?

You have to "calendarize" by adjusting the companies' fiscal years so that they match up.

For example, to make everything match a December 31st year-end date, you take each company with a June 30th fiscal-year end and do the following:

- Start with the company's full June 30th fiscal-year results.
- Add the June 30th – December 31st results from *this* year.
- Subtract the June 30th – December 31st results from the *previous* year.

Normally, you calendarize to match the fiscal year of the company you're valuing.

But you might pick another date if, for example, all the comparable companies have December 31st fiscal years but your company's ends on June 30th.

12. How do you interpret the Public Comps? What does it mean if the median multiples are above or below the ones of the company you're valuing?

The interpretation depends on how the growth rates and margins of your company compare to those of the comparable companies.

Public Comps are most meaningful when the growth rates and margins are **similar,** but the multiples are different. This could mean that the company you're valuing is **mispriced** and that there's an opportunity to invest and make money.

For example, all the companies are growing their revenues at 10-15% and their EBITDAs at 15-20%, and they all have EBITDA margins of 10-15%. Your company also has multiples in these ranges.

However, your company trades at EV / EBITDA multiples of 6x to 8x, while the comparable companies all trade at multiples of 10x to 12x.

That could indicate that your company is **undervalued** since its multiples are lower, but its growth rates, margins, industry, and size are all comparable.

If the growth rates and margins are very different, it's harder to draw conclusions since companies growing at different rates are *expected* to trade at different multiples.

13. Is it valid to include both announced and closed deals in your set of Precedent Transactions?

Yes, because Precedent Transactions reflect **overall market activity**. Even if a deal hasn't closed yet, the simple *announcement* of the deal reflects what one company believes another is worth.

Note that you base all the metrics and multiples on the financial information as of the *announcement dates*.

14. Why do Precedent Transactions often result in more "random" data than Public Comps?

The problem is that the circumstances surrounding each deal might be **very different**.

For example, one company might have sold itself because it was distressed and about to enter bankruptcy.

But another company might have sold itself because the acquirer desperately needed it and was willing to pay a high price.

Some deals are competitive and include multiple acquirers bidding against each other, whereas others are more targeted and do not involve competitive bidding.

All these factors mean that the multiples tend to vary **widely**, more so than the multiples for Public Comps.

15. How do you factor in earn-outs and expected synergies in Precedent Transactions?

You generally don't factor in expected synergies because they're so speculative. If you do include them, you might *increase* the sellers' projected revenue or EBITDA figures so that the valuation multiples end up being *lower*.

Opinions differ on earn-outs, but you could assume that they have a 50% chance of being paid out, multiply the earn-out amounts by 50%, and add them to the purchase prices.

Other people ignore earn-outs or add the full earn-out amounts to the purchase prices.

16. Are there any rules about filtering out deals for less than 100% of companies or about stock vs. cash deals in Precedent Transactions?

Ideally, your set of Precedent Transactions will include **only** 100% acquisition deals.

However, you may need to go beyond that and also include **majority-stake deals** (ones where the acquirer buys more than 50% but less than 100% of the seller).

You can include those because the dynamics are similar, but you should **not** include minority-stake deals because acquiring 10% or 20% of a company is quite different.

Stock vs. cash consideration affects buyers' willingness to pay in M&A deals, but you typically include **all** deals regardless of the form of consideration.

You may note whether each deal was cash, stock, or a mix of both.

17. If there's a Precedent Transaction where the buyer acquired 80% of the seller, how do you calculate the valuation multiples?

The multiples are always based on **100%** of the seller's value.

So if the acquirer purchased 80% of the seller for $500 million, the Purchase Equity Value would be $500 million / 80% = $625 million. And then you would calculate the Purchase Enterprise Value based on that figure plus the usual adjustments.

You would then calculate the valuation multiples based on those figures and the financial stats for 100% of the seller.

18. Why do you use median multiples rather than average multiples or other percentiles?

Median multiples are better than average multiples because of **outliers**.

If there are 5 companies in your set, and the multiples are 8x, 10x, 9x, 8x, and 25x, you don't want the 25x multiple to push up the average when it's clearly an outlier.

However, there's no "rule" that you have to use the median rather than other percentiles.

So you could make an argument for using the 25th percentile or 75th percentile.

For example, you could argue that your company's growth rates and margins are in-line with companies in the 75th percentile of your set and that the multiples of those companies are, therefore, most applicable to your company.

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Other Valuation Methodologies

These questions are unlikely to come up unless you have significant finance experience.

If they do come up, they'll most likely be in the form of straightforward questions on how to set up different analyses and the advantages and disadvantages of each one.

1. What is a Liquidation Valuation, and when is it useful and not so useful?

In a Liquidation Valuation, you value a company by determining the market values of all its Assets, adding them up, and subtracting the market values of all its Liabilities.

It gives you the company's **Implied Equity Value** because you're valuing *all* the company's Assets rather than just its core-business Assets.

This methodology is useful for distressed companies because it tells you how much they might be worth if they have to liquidate and shut down.

It's less useful for healthy, growing companies because it tends to undervalue them grossly. A growing company is worth a lot more than what's on its Balance Sheet because its cash flows will **grow** far into the future.

2. How does a Dividend Discount Model (DDM) differ from a DCF?

In a DDM, rather than projecting Free Cash Flow, you project the company's **Dividends**, usually based on a percentage of Net Income. You then discount the Dividends to their Present Value using the Cost of Equity and add them up.

To calculate the Terminal Value, you use an Equity Value-based multiple such as P / E (or the Gordon Growth Method), and then you discount it to its Present Value using the Cost of Equity.

You get the company's Implied Equity Value at the end rather than its Implied Enterprise Value, so you can divide by its diluted share count to get its Implied Share Price.

The DDM is essential in some industries, such as commercial banks and insurance, useful for other industries that pay regular dividends, such as REITs, utilities, and some MLPs, and not so useful for most others.

3. Why might you use an M&A Premiums analysis to value a company?

The M&A Premiums analysis applies only to **public companies** because you look at acquisitions of similar public companies and calculate the "premium" each buyer paid for each seller.

For example, if the seller's share price was $12.00 before the deal, and the buyer paid $15.00 per share, that is a 25% premium.

You take the median for a set of transactions and then use that to value your company. So if the median premium is 20%, and your company's share price is $10.00, it's worth $12.00 per share.

This analysis is useful when Precedent Transactions give nonsensical or useless results, and you want to use something *other* than traditional multiples to value your company.

For example, if the precedent transactions were all done at EV / EBITDA multiples between 6x and 8x, and your company is currently at trading at 10x, the results don't make sense: A public company can't sell for *less than* its current multiples.

So you could look at the **M&A premiums** instead. If the median premium is 25%, you might apply that to your company's share price and say that a buyer might have to pay that much to do the deal.

4. How do you build a Future Share Price Analysis?

You take the median historical multiple from the Public Comps, often the P / E multiple, and apply it to the *future* metric of the company you're valuing (Net Income or EPS with the P / E multiple).

So you assume that in 1 or 2 years, the company will be trading at the median multiple the comparable companies are *currently* trading at.

For example, if the median P / E is 15x and the company's Year 1 projected EPS is $1.00, you would say the company's expected "future share price" is 15x * $1.00 = $15.00.

Then, you discount this future share price to its Present Value by using a range of values for the company's Cost of Equity.

For Enterprise Value-based multiples, you have to back into the Implied Equity Value and Implied Share Price in the future years and then discount that share price.

5. What are the advantages and disadvantages of a Sum-of-the-Parts Valuation?

The Sum-of-the-Parts methodology, where you value each division of a company separately and add them up to determine the company's Implied Value, works well for conglomerates like General Electric that have *very* different divisions.

The divisions operate in such different industries that it would be meaningless to value the company as a whole – no other company would be truly comparable.

But Sum of the Parts also takes far more time and effort to set up because you have to find comparable companies and transactions for **each division**, build a separate DCF for each division, and so on.

Also, you may not have enough information to do it – companies sometimes don't disclose EBIT or CapEx by division, and they may not disclose the corporate overhead expenses that you must factor in at the end of the analysis.

6. How do you set up an LBO valuation, and when is it useful?

You set up the LBO valuation by creating a leveraged buyout model where a private equity firm acquires a company for a certain price, using Debt and Equity, holds it for several years, and then sells it for a certain multiple of EBITDA.

Since most private equity firms target an internal rate of return (IRR) in a specific range, you **work backward** and determine the purchase price *required* to achieve this IRR.

You use the Goal Seek function in Excel to determine the maximum purchase price the PE firm could pay if it wants to realize a 20% 5-year IRR on a company that it sells for 10x EV / EBITDA.

This methodology is useful for setting a **floor** on a company's valuation – you're constraining the price because of the IRR requirement.

It's also useful for estimating what a private equity firm, rather than a normal company, might be willing to pay for a company.

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